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MAPS – A COMPUTERIZED MANAGEMENT ANALYSIS AND PLANNING SYSTEM

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16. Abstract

MAPS provides managers of large technical projects with a fast and economical information system for planning and controlling their projects. The program in the simplest terms is a computerized bar-chart schedule-reporting system in which project elements at all levels can be listed. MAPS has been specificially designed for planning and scheduling engineering project work; however, its flexible format capability permits a variety of other uses such as parts lists, configuration control, drawing lists, manpower and budget planning, and organization charts. MAPS utilizes a computer; however, it is not essential for the user to know computer programming in order to operate MAPS. An annotated listing of the FORTRAN program is included as an appendix.

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SUMMARY

MAPS provides managers of large technical projects with a fast and economical information system for planning and controlling their projects. The program is written in FORTRAN IV language and is currently being run on an IBM 7094 computer. Input information on schedules and status is simultaneously submitted at all project levels and is automatically collated by the program, resulting in an easy-to-understand output.

Many optional features allow the operator to tailor the program output to local preferences. Legends are completely arbitrary as are schedule calendar formats. Special line items may be selected to print out only on limited listings. Key information may be automatically summarized. Excerpted listings of responsibilities by individuals or organizational segments may be generated.

The program is versatile and can be used for other listings such as parts lists, records of test hours, glossaries, engineering work-order records, etc. The program data can be effectively managed with one part-time operator. An annotated listing of the computer program is included as an appendix.

INTRODUCTION

MAPS, a computerized Management Analysis and Planning System was developed at the NASA Lewis Research Center to provide project managers of large technical projects with a fast and economical information system for planning and controlling their projects. The program was developed after finding that the planning, scheduling, and status updating by the use of other systems on a Lewis project were cumbersome and time consuming, especially when handling large quantities of information. The MAPS program was specifically designed to be a management tool which could readily communicate with all project levels, which would be a ready reference of up-to-date project information, and which would require a minimum of manpower for its maintenance.

The MAPS program is in essence a computerized bar-chart schedule reporting system in which the work structure of a project can be listed at all levels. This system integrates an item of work, its schedule, its status against the schedule, the responsible individual, and brief explanatory comments about the item. In addition, the relation of any single item to other items in the project is clearly shown by a hierarchy form of program organization. The structure of the MAPS program promotes a natural organization of all project work elements and can be used to control down to any level of detail desired.

A key feature of the MAPS program is that each project work element can be keyed to a responsible individual. This is true at all levels of the work structure. The program can give each individual a condensed listing on an item-by-item basis of the project work elements in his area of the project; thus, each individual can see exactly what his project role is and what schedule demands he is working against. This listing is also helpful to management in reviewing manpower requirements and loading.

Another key feature is that the MAPS system is written for fast updating. Thus, management review can always be conducted with up-to-date information. The program has been found most effective when used in conjunction with a biweekly (every 2 weeks) management review meeting. In the meeting the printouts serve as both information and as a format from which to conduct the meeting. In the printouts, all new or updated information is identified as a change from the previous plan or schedule which can be used by management as an exception reporting system. The information on the progress of each project element can be maintained on an exception reporting basis by individuals who are responsible for each work element listed.

Finally, the MAPS program is a resource saving tool. Experience to date has shown that the system for a project involving 100 professional personnel can be maintained by an operator utilizing about one-fourth his time. The MAPS program is written so that no prior computer experience is required for an operator to effectively implement and maintain project computerized outputs.

In addition to its use in scheduling and review, the program can be used to collate and list various types of information. It has been used for drawing lists, parts lists, documentation of test data, engineering work orders, and others.

This report is intended to show the project manager the general utility of this system for his application, to provide the operator with complete information on how to effectively utilize the program including all its optional features, and to provide those who wish to install its use in their own computer facility an annotated listing of the FORTRAN IV program.

DESCRIPTION OF THE PROGRAM AS USED FOR PLANNING AND SCHEDULING

The MAPS program provides a bar-chart output for project review. The format is composed in a form for convenient reading for the user. Figure 1 illustrates a typical page of MAPS schedular output which contains five major column headings. Reading from left to right a line of output identifies the item scheduled, the planned calendar schedule applicable to that item, the status of the item against the planned schedule, a comment, and the person directly responsible for the item.

The organization of the work elements is according to a hierarchal structure. This permits an automatic recognition of both the physical organization of the project (e.g., part A is an element of subassembly B, which is in turn an element of subsystem C, etc.) as well as the line of responsibility. For convenience each item is assigned an arbitrary hierarchy number. As an example of the organization implied by this numbering system, item 41D41 BEARING implies that it is an element of item 41D WHEEL (PRIMARY), which in turn is an element of item 41 COMPONENTS. Likewise, it implies that LENTZ is responsible for BEARINGS to JOULE, who is in turn responsible for the WHEEL (PRIMARY) to NURTZ, who has overall responsibility for COMPONENTS.

The calendar schedule is centrally located on the page. The user can vary the format of the calendar according to his needs. The example shown in this figure has been found most useful for regular detailed project review of current status and for near-term planning. The format preserves the events of the past 6-month period summarized by month. The present 6-month period and the following 6-month period are shown by quarter months (approximate weeks) which has been found to be adequate detail for near-term project control. Events of 1 year hence are carried by month to permit some longer range perspective on the impact of present status.

In order to keep the schedular information in a compact form the various activities are coded according to the legend printed at the bottom of the page. This allows the main flow of activities to be listed on a single line, thereby conserving the physical length of the printout. The legend used is arbitrary and may be varied to suit the individual project. In addition to actual calendar schedules, the schedule format area may also be used for appropriate messages such as the one shown on item 21B.

As a visual aid to reviewing the schedule status, a cursor line of asterisks is positioned in the schedule to show the data of the project schedule review. In figure 1 the asterisk cursor is located under the first quarter of December 1970. Status of each schedule line is then measured relative to the position of the asterisk cursor. The status of each scheduled line is visually presented by overprinting a diagonal slash mark across all completed work. The position of the rightmost slash relative to the asterisk cursor is then a visual indication of actual status against planned schedule.

To the right of the schedule is the COMMENT column (see fig. 1) which is used to report numerically the actual status of the item against the planned schedule. The number indicates the columns of slack (in this case interpreted as weeks) plus or minus relative to the report review data. A brief six-character comment can accompany the numerical status report. This comment may also carry any other information such as total running hours to data, completion dates, etc.

The rightmost column on the page is the person responsible for the item on that line. Identifying each person in this way clearly delineates work areas and responsibilities, and can be further used to automatically summarize total work load for any or all individuals listed.

COMPOSITION OF INPUT DATA DECK

This section describes the preparation of the input data deck in sufficient detail for the beginning user to produce a useful schedular output. Additional program options and uses are discussed later. It is suggested that the user become thoroughly familiar and reasonably proficient with these initial concepts before attempting to use the full complement of options. As mentioned earlier, however, the MAPS operator is not required to know computer programming and can therefore proceed to use MAPS immediately.

The program deck comprises five major sections: control and format deck, identification deck, schedular deck, status deck, and by-man deck as shown in figure 2. Figure 3 shows the areas on the output page where the information from these input cards is printed.

The following is a card-by-card description of the program deck and instructions on its use. Illustrative examples are included. Reference to figures 1 to 4 will aid in understanding this section. Figure 4 shows a detailed listing of each card that produced the printout in figures 1 and 3. Table I is a condensed list of instructions for punching each of the input cards. This table will be helpful to the operator after becoming familiar with the details of this report. In the following sections the card numbers accompanying the card titles correspond to the card numbers in figures 2 and 4 and table I.

Control and Format Cards

Program message card (card 1). - This card is used to print a message at the top of every page. Beginning with column 1, all 80 spaces of the card can be used to show, for example, the title of the program, the latest revision date, and the date of the review.

Control card (card 2). - The control card is used to select various options within the program. The options of immediate interest are described subsequently and additional options are discussed later. For ready reference all options are summarized in table I.

(1) Asterisk cursor in the calendar field - This option positions the asterisk cursor in the calendar field to indicate the date of the schedule review meeting. The calendar field is 66 columns wide. The desired cursor position is indicated by the column number in this field (01 to 66). This number is punched in card columns 1 and 2. If both columns 1 and 2 are blank the cursor will not be printed.

(2) Slash overprint indicating completed work - As a visual aid in reviewing progress, slashes will normally overprint on the schedule field legend marks indicating completed work. As an option, if no slash is desired, a 1 would be punched in card column 6.

(3) New program deck p̃unchout - For the convenience of the program operator, the program can automatically punch a new program deck in correct sorted order and purge any incorrect or obsolete cards. In normal biweekly update, the operator may use this option to call for a new program deck after updating the previous deck. To obtain a new deck a 1 should be punched in card column 35.

Calendar heading cards (cards 3, 4, 5). - Three cards are used for the calendar heading. The first 66 columns on each card are available to compose the format. Normally column 1 is not used in order to reserve it for a program feature which will be explained later.

The first card (card 3) is used to specify the annual calendar and to locate the dots that separate years. The second card (card 4) is used to specify the monthly calendar, with the separating dots spaced semi-annually and matching the yearly separating dots on the previous card. The second card also prints at the bottom of the page. The third calendar heading card (card 5) produces the remainder of the vertical separating dots, which should be matched with those on the previous cards.

The format of these cards is completely optional with one exception. The character used to generate vertical columns may only be a period (.). In some applications of MAPS the user may want the calendar heading to be blank. In this case there must be three blank heading cards in the deck to maintain the proper card sequence.

Legend cards (cards 6, 7, 8). - The MAPS program automatically provides space at the bottom of each page of the printout for a two-line legend. Each printed line is 120 character positions long, and three cards are required to print the two line legend. The first card (card 6) using all 80 columns prints in the first 80 spaces of the top line of legend. The first 40 columns on the second card (card 7) prints out on the last 40 spaces of the top line of legend. The last 40 columns of the second card (card 7) print on the first 40 spaces of the bottom line. The third card (card 8) prints out on the last 80 spaces of the bottom line.

The legend characters are entirely optional with one exception: the character used to indicate a dormant period of no activity between two other activities must be either a dash or blank. The overprint slash which indicates completed work will not overprint either a dash or a blank. In general, the symbols period (.), asterisk (*), and zero (0) should not be a part of the legend repertoire since they have special program meaning. All other symbols may be used. If the legend is not used, three blank cards must be inserted in the deck to maintain the proper card sequence.

ID Deck Cards

Identification or "ID" cards (cards 9). - The ID cards are used to identify or describe the program tasks and the responsible organizations, departments, or personnel. An ID card must always have an "S" in column 1. This is used for card-type recognition to minimize inadvertent input errors from appearing in the printout.

As previously mentioned, each item is assigned a hierarchy number. Columns 3 to 11 are used for this hierarchy number which must always begin in column 3. The hierarchy numbering system is the organizing mechanism used by the program to structure the printout. The program provides for up to six levels of hierarchy. The system of hierarchy identification is a mixture of two digit numbers and single letters in the sequence number-letter-number-letter-number-letter. The leftmost position (number) is the most significant, and the rightmost position (letter) the least significant. The two digit numbers range from 00 to 99. The letters cover the 26 letters A to Z. The MAPS program will accept more than one ID card with the same hierarchy number; however, this feature normally receives only limited use since it confuses the implications of hierarchy for the reader.

A hierarchy number may be assigned at random. The numbers and letters need not be assigned consecutively. For example, a program with five major categories might select the numbers 08, 21, 37, 63, and 92. An advantage of such a selection is that if a sixth major category should be needed at a later date, it can be easily fit into the existing numbering sequence by selecting one of the many unused numbers, say 45. This same reasoning applies to both alphabetic and numeric selections at all hierarchy levels (e.g., see fig. 1).

In selecting a hierarchy structure each level of hierarchy must be filled down to the least significant level chosen. For example, a hierarchy number such as 41D21J21K implies that there must be additional ID cards with the numbers 41D21J21, 41D21J, 41D21, 41D, and 41. Hierarchy levels may not be skipped. The program automatically checks for missing hierarchy levels and prints an error message where the error exists. The hierarchy error shown between items 41L and 41P15 in figure 1 indicates that hierarchy number 41P is missing. Columns 13 to 42 on the ID card are used to print the description of the task, end items, function, etc. This field is always 30 characters long with the indentation on the printout automatically performed by the program according to the hierarchy level. This 30-column field may contain any key-punch character or blanks.

Card columns 44 to 49 are used to name the person or organization responsible for the item described. Although the program will function if these six columns are left blank, it is important to the successful use of this program that an individual person (but at least an organizational segment) be identified as responsible on each ID card. This is important for management in order to pinpoint responsibility. In addition, by using these names, a program option (discussed later) automatically extracts a condensed list of project work elements in each persons area. Names longer than the six allowed character spaces must always be abbreviated in exactly the same way in order to obtain this complete condensed listing.

The special name, TITLE, is inserted in card columns 44 to 48 to create a major title within the output. The lines

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= = = = = = = = = = = = = = = = = = = =
       SUN DIAL I
= = = = = = = = = = = = = = = = = = = =
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in figure 1 are an example of such a major title. A major title always skips to a new page. This special card should be assigned a two digit hierarchy number in the hierarchy number series which then places it in its desired location in the output listing. The title desired is punched in columns 13 to 42.

New or updated ID cards are inserted into the ID deck manually. Replaced or outdated ID cards are removed from the ID deck manually. For ease of locating old ID cards, it has been found good practice to always insert ID cards in their proper hierarchy position in the deck. This is not essential, however, since the program contains an automatic sorting routine.

Asterisk card (cards 10, 14, 18, 20). - Asterisk cards are used to signal the end of different segments of the input data deck. These cards simply have an asterisk (*) punched in card column 1. The remainder of the card is left blank. Each time the new program deck punch option on the control card is utilized, the date on which the deck is punched will appear on the asterisk cards (except on card 20) in columns 7 to 25. All asterisk cards must be inserted as shown in figure 2 for the program to run even if sections beyond the ID deck are not used.

Schedule Deck Cards

Schedule cards (cards 11). - Each schedule card must agree in format with the calendar heading cards described earlier. Schedule card columns 1 to 66 are used for the legend characters or general messages which will appear in the schedule field. As mentioned, periods (.) on the calendar heading card (card 5) supercede any legend characters punched in the same calendar columns. Schedule card columns 70 to 78 must contain the hierarchy number exactly as it is punched in card columns 3 to 11 on the companion ID card. Schedule cards may be inserted in any hierarchy order.

Slash cards (cards 12, 16). - Two slash cards are used in the input data deck, one in the schedule deck and the other in the status deck to be discussed next. The function of this card is to separate previous schedule or status cards from new or updated cards. Like the asterisk card, a slash card has only one character, a slash in column 1. Omission of one or both slash cards will not prevent the program from running but the update indicator of the cards that follow the slash card will not be printed.

Schedule update cards (cards 13). - The schedule update cards are identical in format to the schedule cards in the schedule deck. When the user wishes to update or revise a schedule, he prepares a new card that represents his new schedule, but he retains the same hierarchy number as the old schedule. The updated schedule cards are placed in the deck immediately following the slash card. Each schedule card when located after the slash card will cause an asterisk (*) to print in column 1 of the calendar field, thus marking it as a new or changed input. Four of these asterisks may be seen in figure 1 on items 41D21J21B, 41D21J21K, 41D31, and 41D41. Schedule update cards may be inserted in any hierarchy order. The program automatically uses the last input schedule or schedule update card of any given hierarchy number. A schedule update card will automatically cause any previous status (slack) as indicated on a status card to be blanked out. The output listing will show that the status has been changed and is now reported as being on schedule. Status reported on status update cards will not be changed.

The user need not manually remove previous schedule cards. The computer automatically ignores them and discards them during the punch out of the new deck and the printing of the output.

Asterisk card (card 14). - An asterisk card is located at this position to signal the end of the schedule deck.

Status Deck Cards

Status cards are used to show schedule status with respect to the planned schedule. Status is displayed in two ways, with slashes over completed work (legend characters) and/or as a number in the COMMENT column. The status card is also used for making a brief comment which appears in the COMMENT column. As a matter of practice it has been found advantageous to maintain fixed schedules until the programmatic situation changes sufficiently to warrant a change of schedule projection. In this way it is readily apparent to a manager when progress is other than planned, thereby allowing his assessment of its impact on the overall program. The operator should be alert to persons who tend to change schedules at each update, rather than reporting status against planned schedules.

Status cards (cards 15). - No status card is required for items on schedule, that is, where present activity is correctly indicated by the asterisk cursor line. With the use of the calendar in the example, status can be thought of as weeks of slack (+ or -). The program uses the status number (weeks) to count calendar columns right or left from the asterisk cursor. This positions the slash overprints to strike out completed work only. The slash (/) will not overprint a blank ( ), period (.), dash (-), asterisk (*), or zero (0) due to their special format meaning. In counting columns to determine slash overprint position from the asterisk cursor, the program does not count any column containing a period. This is to allow vertical separator lines through the calendar using periods.

Status card columns 1 to 9 are used for the hierarchy number. The hierarchy number must always begin in column 1 and must be identical to the hierarchy number of the companion ID and schedule cards. Columns 15, 16, and 17 are used for schedule status. A two digit number is always used (e.g., 01, 12) preceded by the sign of the number (+ or -). Columns 23 to 28 may be used for any cryptic comments relevant to the line item. Either the status number (weeks) or the comment may be left blank. Status cards may be inserted in any hierarchy order.

Slash card (card 16). - A slash card is located in the deck at this position to separate prior status cards from status update cards.

Status update cards (cards 17). - The status update cards are identical in format to the status cards. Like the schedule update cards they provide a means of updating status without the necessity of manually removing obsolete cards from the deck. It is only necessary to add an updated status card when there is an actual change in status or comment. An activity which was, for example, 5 weeks behind (-05 status) in the last reporting period and is still 5 weeks behind during the current reporting period requires no update.

The status update cards should immediately follow the slash card. Any status card located in this position in the deck will cause an asterisk (*) to print in the COMMENT column thereby marking the status as new or changed. Two of these asterisks can be seen in figure 1 on items 41B and 41D31. Status update cards may be inserted in any hierarchy order. The program automatically uses the last inputted status or status update card of any given hierarchy number.

Asterisk card (card 18). - An asterisk card is located at this position to signal the end of the status deck.

By-Man Deck Cards

By-man cards (cards 19). - One of the communication features of this program is to be able to generate for each individual a listing of his responsibilities and assignments. This is accomplished by an automatic search through the program deck for all items which show him as being directly responsible, which are his responsibility as implied by hierarchy, or which are higher levels of hierarchy to which he is responsible. As an example, figure 5 shows a by-man listing for BELL. This list is an excerpt from the list in figure 1. In figure 5, the hierarchy organization is meant to imply that the RIM and FRICTION SURFACE are parts of the RING for which BELL is responsible. In the same manner it can also be seen that the RING is a part of the OUTER STRUCTURE which is a part of the HOOP which is in turn a part of the WHEEL (PRIMARY) which is a COMPONENT of SUN DIAL I. The hierarchy organization is also meant to imply that technically, BELL becomes responsible for LENZ's work as well as his own. In addition, BELL must be responsive to EPDERM who must be responsive to SINGER who must be responsive to JOULE who must finally be responsive to HOOKE. Thus, work elements of both higher and lower hierarchy are listed so that BELL may view his jobs and responsibilities in context.

These listings are obtained by inserting cards in the by-man deck, one card for each man. A blank by-man card may be used to obtain a list of all items of unassigned responsibility. The use of by-man cards is optional.

The format of a by-man card is simply the man or organization name punched in card columns 8 to 13, and spelled or abbreviated exactly as in the ID deck.

Asterisk card (card 20). - An asterisk card is located at this position to signal the end of the program deck.

This concludes the description of a complete program deck sufficient to run a basic MAPS listing. The features already described are ample to get a new project organized and the regular review process underway.

WORK SHEET FORMS

As an aid to the program operator in preparing inputs and updates, a set of work sheets have been prepared for the ID, schedule, and status cards. Normally these work sheets are filled out by the responsible persons in each area, approved by their immediate supervisor, and given to the program operator for subsequent updating of the program deck. The work sheets are laid out to correspond directly to the input card column requirements. Master copies of these work sheets are located at the end of this report following figure 8. These may be photocopied for mass reproduction after filling in specific project information such as project name and calendar headings.

SPECIAL OUTPUT FOR PROGRAM OPERATOR

Each time the MAPS program is run, an additional page of information useful to the operator is printed as the first page of the listing. An example of such a printout is shown in figure 6. The brackets in figure 6 are keyed by letters to the headings in this section. The description of this special output follows.

Control Card (bracket A): All program control card inputs are listed for reference. Each option is briefly described.

Error Cards (bracket B): Cards in error from the ID, schedule, and status decks are all listed. An ID card is in error if an S is not punched in column 1. Schedule and status cards are in error if no ID card can be located with an identical hierarchy number. Any cards appearing under this heading are not listed in the printout and are automatically purged from the new program deck if it is selected to be punched.

Flagged ID Cards (bracket C): This is a list of all flagged ID cards and shows the specific flag configuration for each card. Flagged ID cards are discussed later.

Responsible Person List (bracket D): This is a complete list of all the individual names of responsible persons as read from ID cards. It is useful to detect different spellings or abbreviations of a given individual, or to select names for by-man listings.

Valid ID Cards (bracket E): The MAPS program as written is limited in any single program deck to a maximum of 1000 ID cards (line items). This special output gives the total number of valid ID cards inputted. ID cards in error are not included in this total. If more than 1000 valid ID cards are inadvertently inputted, the program processes the first 1000 normally, totally ignores the excess over 1000, and prints an error message to warn the operator.

Hierarchy Errors (bracket F): The number of hierarchy errors found by the program are listed. The location in the deck of such errors may be quickly found by scanning the printout for a break in the vertical lines of dots or asterisks. An example is shown in figure 1.

OPERATION ROUTINE

It has been found convenient to use the following routine in gathering information, processing, and distributing MAPS to management and individuals.

Four Working Days Prior to the Review Meeting: - All new inputs are due to the operator at this time. Inputs are written on specially prepared input work sheets (shown following fig. 8). Each individual is responsible to update his own area of responsibility.

Two Working Days Prior to the Review Meeting: - All inputs are entered into the deck. The program is run for a single proof copy.

One Working Day Prior to the Review Meeting: - A run is made for multiple copies, one copy for each attendee at the review meeting.

Review Meeting Day: - The operator attends the review meeting making notes of changes, corrections, and decisions which reflect adjustments to the schedules. Following the meeting, the operator incorporates the changes from the meeting and runs by-man copies at the same time calling for a new program deck to be punched to be used for the next update.

One Working Day Following Review Meeting Day: - The operator passes out a by-man copy to all individuals with an additional copy of each by-man listing to the individual's supervisor.

The cycle repeats. A 2-week review cycle has been found to be optimum for a project-wide review.

ADDITIONAL PROGRAM OPTIONS

This section describes 10 additional program options which may be used individually or in any combination.

1. Running with Multiple Program Decks

It has been common practice with the writers to include several program decks in one program execution in order to disseminate a variety of information in one document. An example of a typical run includes (1) an overall project master schedule covering a 7-year period, (2) the project detailed schedule covering 6 months of history and 18 months of projection, (3) a glossary of project abbreviation, and (4) a listing of test hours on all components. So that this printout is continuous in its reader information, a program feature allows suppression of the special operator information printout between program decks. This is accomplished by punching a 1 in column 37 of the control card of the first program deck only. Any ID, schedule, or status card error messages, or hierarchy error count will continue to print between program deck listings. This feature is normally used only for runs which are for distribution. Proof copy runs are normally run with all special operator information printing. Multiple deck setup is shown in figure 7. When no by-man cards are used, care should be taken to ensure that there are two asterisk cards between the status deck of one program and the first heading card of the following program.

2. More Than 1000 Cards in ID Deck

The program is limited by core storage of the NASA Lewis Research Center computer to a maximum of 1000 ID cards (item lines). Each ID card may, of course, optionally have a schedule and status card. If it is necessary to utilize more than 1000 ID cards (item lines), two or more program decks may be run simultaneously as described previously. The printout gives a continuous appearance to the reader. A caution should be observed in running in this multiple deck mode. Each program deck is run by the computer as a separate entity. There is no cross referencing from program deck to program deck. Therefore, a summary output (option 4, described subsequently) will only have access to cards in its immediate program deck. Also by-man listings will likewise only have access to cards in the immediate program deck in which the by-man request cards are located.

The control card in the first program deck should be punched with a 1 in column 37. This will blank out operator information between decks (except error cards) which will make the output appear as one continuous listing.

3. Selective Printout by Flagging

The MAPS program can produce three different types of output listings; total, by-man, and summary. Total and by-man listings have already been discussed. Summary listing is described in the next section. A flag option is programmed to allow any item to print or not to print on any listing or combination of listings. Although an item may be flagged for selective printout, the printing will not actually occur unless that form of listing has been requested when the program is run. The total listing is automatically printed every time the program is run. A by-man listing is requested by inserting one or more by-man cards in the program deck. A summary listing is requested by punching a one (1) in control card column 4.

When there is no flag the item will always print on total and by-man listings and never print on the summary listing. When there is a flag, the item will print on the listing(s) specified in table II. The flag (number) is punched in ID card column 51. For example, if an item is to be printed on the by-man and summary listings but not on the total listing, a 5 would be punched in ID card column 51.

At times it may be advantageous to be able to select various groups of items to be listed, for example, there may be different groupings of items to be printed as summaries. The MAPS program permits up to four such groupings by utilizing ID card columns 51, 52, 53, and 54 independently and in exactly the same way as described previously for column 51. Each time the program is run, a different ID card column can be chosen as the basis for selective printout of items. Thus, column 51 can be used to flag grouping number 1, column 52 can be used to flag grouping number 2, etc. When the program is run, the ID card flag column chosen for selective printout (i.e., 51, 52, 53, 54) should be punched in control card columns 10 and 11. If control card columns 10 and 11 are blank the program will automatically assume column 51 is to be chosen. Only one ID card flag column may be selected each time the program is run.

The explanation thus far of selective printout by flagging is sufficient to allow a wide flexibility of its use. The more experienced operator may wish to continue reading at this point to obtain a deeper understanding of the programming details in order to use the option to its fullest advantage. To avoid confusion, it is suggested that the novice operator skip directly to option 4 (summary output).

The flag procedure as described previously is based on a preprogrammed set of printout selection masks, one for each of the three listing types. The program uses these masks to decide whether or not a flagged item is to be printed. This is done by comparing bit by bit the binary representation of the flag with the binary representation of the appropriate mask. The decision to print occurs whenever both binary representations have a 1 bit in at least one of the three bit positions. The binary representations are as follows:

Decimal number	Binary representation
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

The three preprogrammed masks have the decimal values as follows: by-man = 1, total = 2, and summary = 4. Referring to the previous chart shows that a decimal 1 is represented by a 1 in the right bit position, a decimal 2 by a 1 in the middle bit position, and a decimal 4 by a 1 in the left bit position.

As an example of how the comparison is done, when a 5 flag punch is compared to the three preprogrammed masks one at a time as shown in the following chart, a match of bits is found in the left bit position for the summary mask, in the right bit position for the by-man mask, but no match is found for the total mask; thus, this item would print on summary and by-man listings but not on the total listing.

5 Flag on ID card	Binary representation		
	1	0	1
By-man mask(1)	0	0	1
Total mask (2)	0	1	0
Summary mask (4)	1	0	0

Normally, the three preassigned mask values will be adequate to accomplish the selective printouts desired. Occasionally there may be need to change the built-in values to accomplish a special function. The most likely need would be to print a total listing of every item in the program deck whether flagged or not. This can be accomplished by changing the total mask from the preprogrammed value of 2 to a value of 7 (the 7 is represented by a 1 bit in every bit position which assures a match with any flag).

Any of the three mask preprogrammed values can be changed by punching the desired value into the following: summary mask in control card column 22, total mask in control card column 8, and by-man into by-man card column 1. If any of these is left blank the program will automatically assign the mask values by-man = 1, total = 2, and summary = 4 to only the blank mask(s). When the program is run, the actual mask value used along with the ID flag column selected can be found in the printout. The total and summary masks are found in the special operator output, and the by-man mask is found at the top of each by-man page.

4. Summary Output

If the masking feature described previously is used, the program can produce a listing of only flagged items as a summary output that appears ahead of the total output. This summary output is called for by punching a 1 in column 4 of the control card. Since the lines of the summary output may be excerpted from any point in the program and at any hierarchy level, the arrangement in the summary output may appear somewhat disorganized. It may therefore be desirable when using the summary output to insert ID cards which will produce extra item headings to help organize the summary information and which only print out in the summary listing.

5. Blanking of Hierarchy Numbers in Output Listing

It is occasionally desirable to blank out hierarchy numbers on summary and total printouts. An example of this is shown in figure 8(a). This can be readily accomplished by punching in control card columns 32 and 33 the highest hierarchy number which is to be blanked out to the printout. All hierarchy numbers less than or equal to the punched number and all its sublevels will then not appear on the summary and total printouts. This feature will not blank out hierarchy numbers on the by-man output.

6. Preventing the Slash Overprint on Individual Item Schedules

Within the program printout it is convenient to interject notes and comments in the schedule field in place of a normal schedule. For ease of reading, it is desirable to prevent normal overprinting with status slashes on individual item lines where notes are to appear. This prevention of slashes can be accomplished by punching a period (.) in status update card column 15. This period will eppear in the printout under COMMENT as in item number 21B in figure 1.

7. Need Date Overprint

In scheduling important items which interface with other items on the project it may be desirable to establish a demand or needed completion date. This date may be earlier or later than a planned expected completion date. In order that this need date may be held fixed and independent of any schedule changes, a feature is available in the program which overprints a special character in the same manner as status slashes. The special character takes precedence over a slash in the same position and will overprint the legend character.

The symbol to be overprinted at the need date may be selected by the operator. The symbol desired should be punched in column 7 of the control card. If column 7 is blank, the symbol ǂ (colon on the key punch) will automatically be used.

If the need-date overprint is desired for a given item, the schedule field column number (01 to 66) in which the character is to appear, is punched on the schedule card for that item in columns 67 and 68 (the column numbers zero to 9 must appear as two digits 01, 02, --, 09).

If the slash overprint is suppressed with a 1 in column 6 of the control card, the need date symbol is also suppressed.

8. Status Input From the ID Card

Status information may be added to the program from either the status card or from the ID card. Columns 56, 57, and 58 on the ID card serve exactly the same function as columns 15, 16, and 17 on the status card. Likewise columns 60 to 65 on the ID card serve exactly the same function as columns 23 to 28 on the status card. Status from the ID card should be used only when there is no status card in the deck with the same hierarchy number; otherwise, the status card information will take precedence over the ID card. Whenever a new program deck is punched, the status information added by means of an ID card will automatically be transferred to a new status card and not punch out on the new ID card.

9. Other Forms of Hierarchy Numbering

The normal form for hierarchy numbering is NN, L, NN, L, NN, L (N = numeral, L = letter). Automatic indentation of the descriptions occur based on these six hierarchy levels. Within the program these hierarchy characters are all treated alike as alphanumeric symbols: thus, any alpha-numeric symbol may be used in any hierarchy character position. These symbols are sorted in the order of precedence of the normal FORTRAN IV ordering. This ordering is as follows:

0, 1, 2, ..., 9, = , A, B, . . ., R, blank, S, T, . . ., Z

This option can be useful in organizing dictionaries where the hierarchy word can be the exact word to be sorted. Examples of this use are shown in figures 8(h) and (j). This option requires the use of the hierarchy error message blankout described next. In addition, if it is desired to blank out the hierarchy numbers themselves on the output listing, two characters may be punched into control card columns 32 and 33 as described in option 5. The characters can be numerals, letters, or equal sign (=), and they will serve to blank all hierarchy numbers of lower precedence (00 is lowest precedence and ZZ is highest).

10. Hierarchy Error Message Blankout

As mentioned earlier, the program requires levels of hierarchy to be continuous down to the lowest one used. The program automatically checks for this and prints an error message within the output text at any hierarchy error location. When using the program for special applications, such as glossary, parts list, engineering order list, etc., hierarchy characters can be the significant name or number as described above and will in general violate the hierarchy levels requirement. In these special cases the hierarchy error message may be suppressed by punching a 1 in column 41 of the control card. This will also suppress the printing of the total number of hierarchy errors in the special operator information.

SHIFTING THE CALENDAR

In order to keep the calendar current with sufficient room for planning, the calendar must be changed and the schedule must be shifted to the left on the printout periodically. It has been the practice to shift the schedule shown in figure 1 every 6 months when the asterisk cursor has reached or passed column 38. In figure 1, this corresponds to the fourth week in January 1971. It has been found convenient to write a special computer program tailored to the users particular schedule format to perform this shifting operation. After the shifted schedule deck is punched and a printout is run, all project personnel are asked to review the schedule in detail and expand and extend the work plan. This procedure saves the complete manual repunching of the schedule deck.

OTHER PROGRAM USES

The MAPS program has sufficient flexibility to make it useful for a variety of purposes where information is to be maintained in orderly lists. Example of actual program uses are shown in figure 8. These include a long range schedule, a long range schedule keyed to project part numbers, a failure and corrective action report index, a report list, a contractor report list, a drawing file index, a component and system test record, an engineering change order list, a parts list, and a glossary. These illustrate the flexibility of the "calendar" field format and of the hierarchy numbering system. The common denominator of all the uses is the ease of inserting and removing items at the appropriate location in a list.

When all 66 calendar field columns are needed and when there is no need to tag new calendar field entries with an asterisk in column 1 of the calendar field, the slash card should be removed from the schedule deck. Removing the slash card will prevent the asterisk from appearing thus making all 66 columns available for information.

EXPERIENCE WITH MAPS

The MAPS program has been written to provide a convenient, thorough, and maintainable project information system. The program has been used successfully for project review every two weeks for four years to coordinate the effort of 200 professional and nonprofessional personnel. Once the project information was organized, it has required approximately 25 percent of one man's time for maintenance of the input data and operation of the program for a set of program decks typically totaling 1100 items. It has been found a most effective tool for project management and maintenance and dissemination of detailed project information. A wide variety of lists including schedules, test hours, glossary, parts list, engineering order list, failure report list, and others have been conveniently maintained by means of the MAPS program.

An important feature of the program is ease of readability by the uninitiated reader. Experience with MAPS indicates little difficulty in quickly grasping the information listed by the program.

Most of all, the MAPS program has provided a means to generate a dynamic document displaying all aspects of a complex project using limited manpower to do so. This documentation has provided a valuable management tool to maintain orderly, efficient, and coordinated project progress.

Lewis Research Center
National Aeronautics and Space Administration,
Cleveland, Ohio, November 6, 1970,
120-27.

APPENDIX - MAPS FORTRAN PROGRAM LISTING

```
$IBFTC MAPS    DECK                                                     MAPS   1
C      THIS PROGRAM IS CALLED MAPS, AN ACRONYM FOR MANAGEMENT ANALYSIS  MAPS   2
C AND PLANNING SYSTEM.  THE FOLLOWING ARE SOME SUGGESTIONS AND TIPS ON  MAPS   3
C IMPLEMENTING THIS PROGRAM ON YOUR COMPUTER.  PRESENTLY IT IS RUN ON   MAPS   4
C AN IBM 7094, A 36 BIT WORD MACHINE WITH 32,768 WORDS OF CORE MEMORY.  MAPS   5
C                                                                       MAPS   6
C     THIS PROGRAM IS WRITTEN IN FORTRAN IV FOR EXECUTION ON A 36 BIT   MAPS   7
C WORD COMPUTER.  BY CUSTOM WRITING FOUR FUNCTION SUBPROGRAMS IT SHOULD MAPS   8
C BE POSSIBLE TO USE THIS PROGRAM ON ANY COMPUTER WITH 36 OR MORE BITS  MAPS   9
C PER WORD.  THE FOUR FUNCTIONS ARE ACCUMULATOR RIGHT SHIFT (ARS,IARS), MAPS  10
C ACCUMULATOR LEFT SHIFT (ALS,IALS), LOGICAL-AND (AND), AND LOGICAL-OR  MAPS  11
C (OR).  IN GENERAL THESE FOUR FUNCTIONS                                MAPS  12
C ARE USED TO STANDARDIZE WORDS FOR MASK COMPARISON. IN SOME LOCATIONS  MAPS  13
C THESE FUNCTIONS ARE USED TO TRANSFORM HOLLERITH NUMBERS INTO INTEGER  MAPS  14
C NUMBERS.                                                              MAPS  15
C                                                                       MAPS  16
C     HOLLERITH MANIPULATION REPRESENTS THE MAJOR USE OF THESE FUNCTION  MAPS  17
C SUBPROGRAMS.  IT IS EXPECTED THAT THE MAPS PROGRAM WILL EXECUTE AS    MAPS  18
C WRITTEN IF THE FUNCTIONS ARE CAREFULLY PROGRAMMED.                    MAPS  19
C HOWEVER, THE NUMBER TRANSFORMATION SECTIONS                           MAPS  20
C OF THE MAPS PROGRAM MAY NEED TO BE REWRITTEN DEPENDING ON YOUR        MAPS  21
C COMPUTER,S INTEGER REPRESENTATION.                                    MAPS  22
C STATEMENTS INVOLVING NUMBER TRANSFORMATIONS ARE MAPS 138, 166, 170,   MAPS  23
C 173, AND OPRINT 32, 34, 36, 38, 117, 119, 120.                        MAPS  24
C                                                                       MAPS  25
C----------FUNCTION SUBPROGRAM FOR LEFT, RIGHT SHIFT-------------------- MAPS  26
C      THE  SHIFT FUNCTIONS ASSUME THAT ZEROS WILL BE LOADED INTO BIT   MAPS  27
C POSITIONS MOVED INTO THE REGISTER BY THE SHIFT.  AN EXAMPLE OF USE FOR MAPS  28
C THESE FUNCTIONS IS                                                    MAPS  29
C                                                                       MAPS  30
C     X=ALS(24,ARS(12,X))                                               MAPS  31
C                                                                       MAPS  32
C THIS STATEMENT WOULD TRANSFORM FOR EXAMPLE THE HOLLERITH WORD X=ABCDEF MAPS  33
C INTO THE HOLLERITH WORD X=CD0000.                                     MAPS  34
C                                                                       MAPS  35
C----------FUNCTION SUBPROGRAMS FOR LOGICAL-AND, OR--------------------- MAPS  36
C     THE LOGICAL-AND AND LOGICAL-OR FUNCTIONS ARE USED TO TRANSFORM TWO MAPS  37
C WORDS INTO A THIRD WORD CONSIDERING EACH BIT OF THE 36 BIT WORD       MAPS  38
C SEPARATELY.  THESE FUNCTIONS OPERATE SIMULTANEOUSLY, HOWEVER, ON      MAPS  39
C ALL 36 BITS. THE LOGICAL OPERATIONS FOR ONE BIT POSITION ARE          MAPS  40
C SUMMARIZED AS FOLLOWS                                                 MAPS  41
C                                                                       MAPS  42
C     LOGICAL-AND                        LOGICAL-OR                     MAPS  43
C     X=AND(A,B)                         X=OR(A,B)                      MAPS  44
C  A=  0    0    1    1               A=  0    0    1    1              MAPS  45
C  B=  0    1    0    1               B=  0    1    0    1              MAPS  46
C     ---  ---  ---  ---                 ---  ---  ---  ---             MAPS  47
C  X=  0    0    0    1               X=  0    1    1    1              MAPS  48
C                                                                       MAPS  49
C  THESE TWO FUNCTIONS ARE USED FOR MASKING AND COMPOSING HOLLERITH     MAPS  50
C  WORDS.                                                               MAPS  51
C                                                                       MAPS  52
C     SINCE CONSIDERABLE HOLLERITH MANIPULATION IS DONE BY THE PROGRAM  MAPS  53
C  THE MACHINE OCTAL REPRESENTATIONS FOR HOLLERITH CHARACTERS IS LISTED MAPS  54
C  HERE FOR REFERENCE. THESE ARE USED TO COMPOSE SOME OF THE OCTAL MASKS MAPS  55
C  IN THE PROGRAM.                                                      MAPS  56
```

```
C      HOL   OCT        HOL   OCT        HOL   OCT        HOL   OCT        HOL   OCT          MAPS  57
C      ---   ---        ---   ---        ---   ---        ---   ---        ---   ---          MAPS  58
C       0     00         A     21         K     42         U     64         =     13          MAPS  59
C       1     01         B     22         L     43         V     65         /     61          MAPS  60
C       2     02         C     23         M     44         W     66         *     54          MAPS  61
C       3     03         D     24         N     45         X     67         +     20          MAPS  62
C       4     04         E     25         O     46         Y     70         -     40          MAPS  63
C       5     05         F     26         P     47         Z     71         =     72          MAPS  64
C       6     06         G     27         Q     50         .     33         '     14          MAPS  65
C       7     07         H     30         R     51         ,     73         $     53          MAPS  66
C       8     10         I     31         S     62         )     34       BLANK   60          MAPS  67
C       9     11         J     41         T     63         (     74         ‡     12          MAPS  68
C                                                                                              MAPS  69
C      ALL STATEMENTS IN THE PROGRAM WHICH INVOLVE LOGICAL OPERATIONS                          MAPS  70
C I.E. ALS, IALS, ARS, IARS, AND, OR, ARE PRECEEDED BY THE COMMENTS CARD                       MAPS  71
C                                                                                              MAPS  72
C              LOGICAL STATEMENT FOLLOWS                                                       MAPS  73
C                                                                                              MAPS  74
C DUE TO THE DECK SIZE,THIS PROGRAM USES OVERLAY AMONG SUBROUTINES                             MAPS  75
C CHECK,PUNOUT,PICK,OPRINT, AND SORTER.                                                        MAPS  76
C                                                                                              MAPS  77
C THE VARIABLES Q1, Q2, ETC. IN READ STATEMENTS 110, 124, AND 128 ARE                          MAPS  78
C USED ONLY WHEN PRINTING ERROR CARDS.                                                         MAPS  79
C                                                                                              MAPS  80
C                                                                                              MAPS  81
      DATA FBL,FIF/6H  0000,2H51/                                                              MAPS  82
      DATA TAXX/0777777777770/                                                                 MAPS  83
      DATA INEED/0120000000000/                                                                MAPS  84
      DATA XMAN(200)/6HBLANK /                                                                 MAPS  85
      DATA KSA/0/                                                                              MAPS  86
      DATA SLASH/1H//                                                                          MAPS  87
      DATA IN/0000000000001/                                                                   MAPS  88
      DATA TXQ/0000000000002/                                                                  MAPS  89
      DATA ROX1,ROX2/6H*00000,0007777777777/                                                   MAPS  90
      DATA TAST,TASX/6H000*00,0777777000000/                                                   MAPS  91
      DATA TOT,EQUAL/5HTITLE,6H======/                                                         MAPS  92
      DATA SY,AST,BLANK,MSK1,MSK2,BNK1,BNK2,DASH,ASTQ,CEEQ,BANK,FLQ/1HS,                       MAPS  93
     11H*,1H ,0000000000077,0000000007777,0000000000060,0000000006060,6H                       MAPS  94
     2------,0000000000054,0777777777700,0606060606060,0606060606054/                          MAPS  95
      DATA MSK(1,1),MSK(1,2),MSK(1,3),MSK(1,4),MSK(1,5),MSK(1,6),MSK(2,1                       MAPS  96
     1),MSK(2,2),MSK(2,3),MSK(2,4),MSK(2,5),MSK(2,6)/0777700000000,07777                       MAPS  97
     277000000,0777777777700,0777777777700,0777777777700,0777777777700,0                       MAPS  98
     3C00000000000,0000000000000,0000000000000,0770000000000,0777777000000                     MAPS  99
     400,0777777770000/                                                                        MAPS 100
      DATA XNPX/0000000777777/                                                                 MAPS 101
      DATA SYB/0120000000000/                                                                  MAPS 102
      DATA MXK/6H000000/                                                                       MAPS 103
      DATA TASQ/0000000770000/                                                                 MAPS 104
      DATA ROX3/0770000000000/                                                                 MAPS 105
      DIMENSION ZMAN(20), XLGND(42), H(8)                                                      MAPS 106
      DIMENSION SP1(11), SP2(11)                                                               MAPS 107
      DIMENSION MSP1(11), MSP2(11)                                                             MAPS 108
      DIMENSION HEAD1(11), HEAD2(11), HEAD3(11)                                                MAPS 109
      DIMENSION GEN(2,1000), TITLE(5,1000), RSP(1000), CODE(1000), STAT(                       MAPS 110
     11000), COMENT(1,1000), KOUNT(1001), XMAN(200), XORG(100), SKED(11)                       MAPS 111
     2, SCHD(11,1000), TAME(3), HEADNG(14)                                                     MAPS 112
      DIMENSION MSK(2,6), IZAM(2)                                                              MAPS 113
      EQUIVALENCE (MSP1(1),SP1(1)), (MSP2(1),SP2(1)), (KLANK,BLANK)                            MAPS 114
      EQUIVALENCE (H(1),KOLUMN), (H(2),KEND), (H(3),IZAM(1)), (H(8),KPUN                       MAPS 115
     1CH), (H(5),KTI), (H(6),KBIN), (H(7),NOHE), (B,NB)                                        MAPS 116
      COMMON NUMBER,GEN,SCHD,LINE,KOLUMM                                                       MAPS 117
      COMMON TITLE,RSP,CODE,STAT,COMENT                                                        MAPS 118
      COMMON KOUNT                                                                             MAPS 119
      REAL IN,MANL,MAINL,MASUM,MXK
C
C
C  BEGIN  EXECUTABLE PROGRAM
C PROGRAM MESSAGE CARD (CARD 1)
101   READ (5,166) HEADNG
C
      IF (KSA.EQ.0) WRITE (6,167) (DASH,J=1,22),BLANK
C
C CONTROL CARD (CARD 2)
      READ (5,168) KOLUMN,KEND,IZAM,MAINL,MASUM,XNPR,KPUNCH,KTI,KBIN,NOH
     1E
C
      KPUN=KPUNCH
C
      KTM=0
      KERR=0
C             LOGICAL STATEMENT FOLLOWS
      H(8)=ARS(33,ALS(9,KPUNCH))
C
      IF (KPUNCH.GT.0) PUNCH 166, HEADNG
C
      IF (KPUNCH.GT.0) PUNCH 168, KOLUMN,KEND,IZAM,MAINL,MASUM,XNPR,KPUN
     1,KTI,KBIN,NOHE
C
      IF (IZAM(2).EQ.KLANK) IZAM(2)=INEED
C
      IF (KSA.EQ.0) WRITE (6,169) KOLUMN,KEND,IZAM(1)
C
      KSET=1
C
C SUBROUTINE FLAG WITH KSET=1 ASSIGNS THE TOTAL AND SUMMARY LISTING
C MASKS AND THE ID CARD FLAG COLUMN.
      CALL FLAG (MAINL,MASUM,MANL,CODE,LINE,MANOUT,KEND,KGT,KSET)
C
C             LOGICAL STATEMENT FOLLOWS
      FLGU=ALS(24,ARS(12,MAINL))
C
C
      IF (XNPR.EQ.BLANK) XNPR=MXK
C
      IF (KSA.EQ.0) WRITE (6,170) IZAM(2),SYB,MAINL,FLGU,MASUM
C
      IF (KSA.EQ.0) WRITE (6,171) XNPR,KPUN,KTI,NOHE
C
C             LOGICAL STATEMENT FOLLOWS
      B=ARS(33,ALS(3,H(1)))
      DO 102 JH=1,7
      IF (JH.EQ.4) GO TO 102
C             LOGICAL STATEMENT FOLLOWS
      H(JH)=ARS(32,ALS(8,H(JH)))
102   CONTINUE
C             LOGICAL STATEMENT FOLLOWS
      KOLUMN=KOLUMN+10*NB
      IF (KOLUMN.LT.0.OR.KOLUMN.GT.66) KOLUMN=0
      KOLUMM=KOLUMN
C             LOGICAL STATEMENT FOLLOWS
      XNPR=OR(ARS(6,XNPR),XNPX)
      MANOUT=0
      JPAGE=0
      IF (KOLUMN.EQ.0) GO TO 104
      CEEP=CEEQ
      FLP=FLQ
      ASTR=ASTQ
      KRK=(KOLUMN+5)/6
      KOL=KOLUMN-6*KRK+6
      KSHFT=36-6*KOL
C             LOGICAL STATEMENT FOLLOWS
      SRK=ALS(KSHFT,MSK1)
C             LOGICAL STATEMENT FOLLOWS
      BRK=ALS(KSHFT,BNK1)
C             LOGICAL STATEMENT FOLLOWS
      ASTR=ALS(KSHFT,ASTR)
      IF (KOL.EQ.6) GO TO 104
      DO 103 J=KOL,5
C             LOGICAL STATEMENT FOLLOWS
      FLP=OR(ALS(6,FLP),BNK1)
C             LOGICAL STATEMENT FOLLOWS
103   CEEP=OR(ALS(6,CEEP),MSK1)
104   CONTINUE
C
C CALENDAR HEADING CARDS (CARDS 3,4,5)
      READ (5,172) (HEAD1(J),J=1,11),(HEAD2(J),J=1,11),(HEAD3(J),J=1,11)
C
      IF (KPUNCH.GT.0) PUNCH 172, (HEAD1(J),J=1,11),(HEAD2(J),J=1,11),(H
     1EAD3(J),J=1,11)
C
C LEGEND CARDS (CARDS 6,7,8)
      READ (5,173) XLGND
C
      IF (KPUNCH.GT.0) PUNCH 173, XLGND
C
      DO 105 JQZ=1,11
      MSP1(JQZ)=0
105   MSP2(JQZ)=0
      DO 109 JQZ=1,11
      MSR=MSK(2,4)
C             LOGICAL STATEMENT FOLLOWS
      PER=ALS(30,BNK1)
      DO 108 JQX=1,6
C             LOGICAL STATEMENT FOLLOWS
      IF (AND(HEAD3(JQZ),MSR).NE.PER) GO TO 106
C             LOGICAL STATEMENT FOLLOWS
      SP1(JQZ)=OR(MSP1(JQZ),MSR)
      GO TO 107
C             LOGICAL STATEMENT FOLLOWS
106   SP2(JQZ)=OR(MSP2(JQZ),AND(HEAD3(JQZ),MSR))
C             LOGICAL STATEMENT FOLLOWS
107   PER=ARS(6,PER)
C             LOGICAL STATEMENT FOLLOWS
108   MSR=IARS(6,MSR)
109   CONTINUE
C             LOGICAL STATEMENT FOLLOWS
      IF (KOLUMN.NE.0) HEAD3(KRK)=OR(ASTR,AND(HEAD3(KRK),CEEP))
C
      IF (KSA.EQ.0) WRITE (6,174)
C
C **** START ID CARD READ ****
      XMAN(1)=BANK
      MAN=1
      DO 119 J=1,999
C
C ID DECK (CARDS 9), AND ASTERISK CARD (CARD 10)
110   READ (5,175) ST,Q1,(GEN(K,J),K=1,2),Q2,(TITLE(K,J),K=1,5),Q3,RSP(J
     1),Q4,CODE(J),Q5,STAT(J),Q6,(COMENT(K,J),K=1,1),Q7,Q8,Q9
C
      IF (ST.EQ.SY) GO TO 111
      IF (ST.EQ.AST) GO TO 121
C
      WRITE (6,176) ST,Q1,(GEN(K,J),K=1,2),Q2,(TITLE(K,J),K=1,5),Q3,RSP(
     1J),Q4,CODE(J),Q5,STAT(J),Q6,(COMENT(K,J),K=1,1),Q7,Q8,Q9
C
      KERR=1
      GO TO 110
111   IF (GEN(2,J).EQ.BLANK) GO TO 112
C             LOGICAL STATEMENT FOLLOWS
      IF (AND(MSK1,ARS(12,GEN(2,J))).NE.BNK1) GO TO 113
C             LOGICAL STATEMENT FOLLOWS
      IF (AND(MSK2,ARS(18,GEN(2,J))).NE.BNK2) GO TO 114
      KOUNT(J)=4
      GO TO 117
C             LOGICAL STATEMENT FOLLOWS
112   IF (AND(MSK2,ARS(6,GEN(1,J))).NE.BNK2) GO TO 115
C             LOGICAL STATEMENT FOLLOWS
      IF (AND(MSK1,ARS(18,GEN(1,J))).NE.BNK1) GO TO 116
C             LOGICAL STATEMENT FOLLOWS
      IF (AND(MSK2,ARS(24,GEN(1,J))).EQ.BNK2) GO TO 116
      KOUNT(J)=1
      GO TO 117
113   KOUNT(J)=6
      GO TO 117
114   KOUNT(J)=5
      GO TO 117
115   KOUNT(J)=3
      GO TO 117
116   KOUNT(J)=2
117   DO 118 JMAN=1,MAN
      IF (XMAN(JMAN).EQ.RSP(J)) GO TO 119
118   CONTINUE
      MAN=MAN+1
      XMAN(MAN)=RSP(J)
119   CONTINUE
C
      WRITE (6,177)
C
C THIS READ SEARCHES ONLY FOR THE ASTERISK (CARD 10) IF MORE THAN 1000
C ID CARDS HAVE BEEN ALREADY READ IN
120   READ (5,178) QXJ
C
      IF (QXJ.NE.AST) GO TO 120
C
C ALL CARDS READ IN AND BAD CARDS REJECTED
121   NUMBER=J-1
C
C  SORTER SORTS CARDS INTO ASCENDING HIERARCHY ORDER
      CALL SORTER (KXM)
C
C  CHECK LOOKS FOR HIERARCHY ERRORS
      CALL CHECK (KXM)
C
```

```
      IF (KSA.EQ.0) WRITE (6,179)
C
C **** START SCHEDULE CARD READ ****
      DO 123 LX=1,11
      DO 122 JX=1,NUMBER
122   SCHD(LX,JX)=HEAD3(LX)
123   CONTINUE
      KOG=0
C
C SCHEDULE JPDATE DECK INCLUDING SCHEDULE CARDS, SLASH CARD, SCHEDULE
C UPDATE CARDS, AND ASTERISK CARD (CARDS 11,12,13,14)
124   READ (5,180) (SKED(J),J=1,11),ANEED,Q1,GEN1,GEN2,Q2
C
      IF (SKED(1).EQ.AST) GO TO 127
      IF (SKED(1).EQ.SLASH) KOG=1
      IF (SKED(1).EQ.SLASH) GO TO 124
      KFLAG=0
      DO 126 JJ=1,NUMBER
C             LOGICAL STATEMENT FOLLOWS
      IF (GEN1.NE.AND(GEN(1,JJ),TAXX)) GO TO 126
      IF (GEN2.NE.GEN(2,JJ)) GO TO 126
C             LOGICAL STATEMENT FOLLOWS
      GEN(1,JJ)=OR(GEN(1,JJ),TXQ)
C             LOGICAL STATEMENT FOLLOWS
      CODE(JJ)=OR(ALS(12,ARS(12,CODE(JJ))),ARS(24,ANEED))
      KFLAG=1
      DO 125 JR=1,11
C             LOGICAL STATEMENT FOLLOWS
125   SCHD(JR,JJ)=OR(MSP2(JR),AND(MSP1(JR),SKED(JR)))
C             LOGICAL STATEMENT FOLLOWS
      IF (KOLUMN.GT.0.AND.AND(SCHD(KRK,JJ),SRK).EQ.BRK) SCHD(KRK,JJ)=OR(
     1ASTR,AND(SCHD(KRK,JJ),CEEP))
C             LOGICAL STATEMENT FOLLOWS
      IF (KOG.EQ.1) SCHD(1,JJ)=OR(ROX1,AND(ROX2,SCHD(1,JJ)))
126   CONTINUE
      IF (KFLAG.EQ.1) GO TO 124
C
      WRITE (6,181) (SKED(J),J=1,11),ANEED,Q1,GEN1,GEN2,Q2
C
      KERR=1
      GO TO 124
127   CONTINUE
      IF (KSA.EQ.0) WRITE (6,179)
C
C **** START STATUS CARD READ ****
      KOG=0
C
C STATUS DECK INCLUDING STATUS CARDS, SLASH CARD, STATUS UPDATE CARD,
C AND ASTERISK CARD (CARDS 15,16,17,18)
128   READ (5,182) GEN1,GEN2,Q1,WKS,Q2,COT1,Q3,Q4,Q5,Q6,Q7,Q8,Q9,Q10,Q11
C
      IF (GEN1.EQ.AST) GO TO 130
      IF (GEN1.EQ.SLASH) KOG=1
      IF (GEN1.EQ.SLASH) GO TO 128
      DO 129 JJ=1,NUMBER
C             LOGICAL STATEMENT FOLLOWS
      IF (GEN1.NE.AND(GEN(1,JJ),TAXX)) GO TO 129
      IF (GEN2.NE.GEN(2,JJ)) GO TO 129
      STAT(JJ)=WKS
C             LOGICAL STATEMENT FOLLOWS
```

```
      IF (KOG.EQ.1) STAT(JJ)=OR(TAST,AND(STAT(JJ),TASX))
      COMENT(1,JJ)=COT1
      GO TO 128
129   CONTINUE
C
      WRITE (6,183) GEN1,GEN2,Q1,WKS,Q2,COT1,Q3,Q4,Q5,Q6,Q7,Q8,Q9,Q10,Q1
     11
C
      KERR=1
      GO TO 128
130   DO 131 JJ=1,NUMBER
C             LOGICAL STATEMENT FOLLOWS
      IF (AND(SCHD(1,JJ),ROX3).NE.ROX1.OR.AND(STAT(JJ),TASQ).EQ.TAST.OR.
     1STAT(JJ).EQ.BLANK) GO TO 131
C             LOGICAL STATEMENT FOLLOWS
      STAT(JJ)=OR(TAST,AND(BLANK,TASX))
131   CONTINUE
C
      IF (KERR.EQ.0.AND.KSA.EQ.0) WRITE (6,184) BLANK
C
C   PUNOUT PUNCHES A NEW ID,SCHEDULE,AND STATUS DECK
      IF (KPUNCH.GT.0) CALL PUNOUT
C
C   PICK LISTS THOSE CARDS WITH A NON BLANK FLAG FIELD (CC 51-54) ON
C   THE ID CARD
      IF (KSA.EQ.0) CALL PICK (GEN,CODE,NUMBER)
C
      IF (KSA.EQ.0) WRITE (6,185) (XMAN(JAB),JAB=1,MAN)
C
      IF (KSA.EQ.0) WRITE (6,186) NUMBER
C
      IF (KXM.NE.0.AND.NOHE.EQ.0) WRITE (6,187) KXM
C
C
C     **** START OF PROCESSING ****
132   CONTINUE
      LINE=1
      KSET=2
C SUBROUTINE FLAG WITH KSET=2 ASSIGNS THE BY-MAN LISTING MASK.
      CALL FLAG (MAINL,MASUM,MANL,CODE,LINE,MANOUT,KEND,KGT,KSET)
C
133   JPAGE=JPAGE+1
C
      WRITE (6,188) HEADNG
C
      IF (XMAN(1).EQ.BLANK) JMAN=200
C
      IF (MANOUT.EQ.1) WRITE (6,189) XMAN(JMAN),MANL
C
      IF (JMAN.EQ.200) JMAN=1
C
      WRITE (6,190) (HEAD1(KPX),KPX=1,11),(HEAD2(KPX),KPX=1,11),(DASH,J=
     11,22)
C
      LNT=0
      IF (MANOUT.EQ.1) LNT=2
      GO TO 135
134   LINE=LINE+1
135   IF (LINE.GT.NUMBER) GO TO 163
      IF (MANOUT.EQ.0) GO TO 139
      IF (RSP(LINE).EQ.XMAN(JMAN)) GO TO 136
      GO TO 137
C             LOGICAL STATEMENT FOLLOWS
136   IF (KOUNT(LINE).GT.KIX.AND.AND(GEX1,MSK(1,KIX)).EQ.AND(GEN(1,LINE)
     1,MSK(1,KIX)).AND.AND(GEX2,MSK(2,KIX)).EQ.AND(GEN(2,LINE),MSK(2,KIX
     2))) GO TO 140
      KIX=KOUNT(LINE)
      GEX1=GEN(1,LINE)
      GEX2=GEN(2,LINE)
      GO TO 140
137   KXXL=KOUNT(LINE)
C             LOGICAL STATEMENT FOLLOWS
      IF (KXXL.GT.KIX.AND.AND(GEX1,MSK(1,KIX)).EQ.AND(GEN(1,LINE),MSK(1,
     1KIX)).AND.AND(GEX2,MSK(2,KIX)).EQ.AND(GEN(2,LINE),MSK(2,KIX))) GO
     2TO 140
      IF (GEX1.EQ.GEN(1,LINE).AND.GEX2.EQ.GEN(2,LINE)) GO TO 160
      DO 138 JKMA=LINE,NUMBER
      IF (KOUNT(JKMA+1).LE.KXXL) GO TO 160
      IF (RSP(JKMA+1).EQ.XMAN(JMAN)) GO TO 140
138   CONTINUE
      GO TO 160
139   CONTINUE
140   NUM=KOUNT(LINE)
      KSET=3
C SUBROUTINE FLAG WITH KSET=3 DECIDES WHEN A CARD SHOULD PRINT.
      CALL FLAG (MAINL,MASUM,MANL,CODE,LINE,MANOUT,KEND,KGT,KSET)
C
      IF (KGT.EQ.1) GO TO 160
      IF (TOT.NE.RSP(LINE)) GO TO 141
      IF (MANOUT.EQ.1) GO TO 160
C
      WRITE (6,191) ((HEAD3(KPX),KPX=1,11),K=1,2),(EQUAL,K=1,6),(HEAD3(K
     1PX),KPX=1,11),(TITLE(KPX,LINE),KPX=1,5),(HEAD3(KPX),KPX=1,11),(EQU
     2AL,KPX=1,6),(HEAD3(KPX),KPX=1,11)
C
      LNT=5
      GO TO 160
141   TEMX1=GEN(1,LINE)
      TEMX2=GEN(2,LINE)
C             LOGICAL STATEMENT FOLLOWS
      IF (ARS(6,GEN(1,LINE)).GT.XNPR.OR.MANOUT.EQ.1) GO TO 142
C             LOGICAL STATEMENT FOLLOWS
      GEN(1,LINE)=OR(BLANK,AND(GEN(1,LINE),IN))
      GEN(2,LINE)=BLANK
C
C
C     **** START OF SCHEDULE OUTPUTING ****
142   IF (NUM-2) 145,149,143
143   IF (NUM-4) 151,153,144
144   IF (NUM-6) 155,157,157
145   IF (LNT.LT.38) GO TO 147
      IF (MANOUT.EQ.1) GO TO 161
      KKX=1
      DO 146 JX=LINE,NUMBER
      IF (KOUNT(JX+1).EQ.1.AND.LNT.LE.44) GO TO 147
      IF (KKX.GT.(44-LNT)) GO TO 161
146   KKX=KKX+1
C             LOGICAL STATEMENT FOLLOWS
147   IF (AND(GEN(1,LINE),IN).EQ.0.0.OR.NOHE.EQ.1) GO TO 148
C
```

```
      WRITE (6,192)
C
      LNT=LNT+1
C
148   WRITE (6,193) ((HEAD3(KPX),KPX=1,11),KPZ=1,2)
C
      WRITE (6,194) GEN(1,LINE),(TITLE(KX,LINE),KX=1,5),(SCHD(KX,LINE),K
     1X=1,11),STAT(LINE),(COMENT(KX,LINE),KX=1,1),RSP(LINE)
C
C  OPRINT SETS UP AND PRINTS THE SLASH AND NEED DATE SCHEDULE OVERPRINT
      CALL OPRINT (STAT(LINE),IZAM)
C
      WRITE (6,195) (DASH,KK=1,5),(HEAD3(KPX),KPX=1,11)
C
      LNT=LNT+4
      GO TO 159
C            LOGICAL STATEMENT FOLLOWS
149   IF (AND(GEN(1,LINE),IN).EQ.0.0.OR.NOHE.EQ.1) GO TO 150
C
      WRITE (6,192)
C
      LNT=LNT+1
C
150   WRITE (6,196) GEN(1,LINE),(TITLE(KX,LINE),KX=1,5),(SCHD(KX,LINE),K
     1X=1,11),STAT(LINE),(COMENT(KX,LINE),KX=1,1),RSP(LINE)
C
      CALL OPRINT (STAT(LINE),IZAM)
C
      LNT=LNT+1
      GO TO 159
C            LOGICAL STATEMENT FOLLOWS
151   IF (AND(GEN(1,LINE),IN).EQ.0.0.OR.NOHE.EQ.1) GO TO 152
C
      WRITE (6,192)
C
      LNT=LNT+1
C
152   WRITE (6,197) GEN(1,LINE),(TITLE(KX,LINE),KX=1,5),(SCHD(KX,LINE),K
     1X=1,11),STAT(LINE),(COMENT(KX,LINE),KX=1,1),RSP(LINE)
C
      CALL OPRINT (STAT(LINE),IZAM)
C
      LNT=LNT+1
      GO TO 159
C            LOGICAL STATEMENT FOLLOWS
153   IF (AND(GEN(1,LINE),IN).EQ.0.0.OR.NOHE.EQ.1) GO TO 154
C
      WRITE (6,192)
C
      LNT=LNT+1
C
154   WRITE (6,198) GEN(1,LINE),GEN(2,LINE),(TITLE(KX,LINE),KX=1,5),(SCH
     1D(KX,LINE),KX=1,11),STAT(LINE),(COMENT(KX,LINE),KX=1,1),RSP(LINE)
C
      CALL OPRINT (STAT(LINE),IZAM)
C
      LNT=LNT+1
      GO TO 159
C            LOGICAL STATEMENT FOLLOWS
155   IF (AND(GEN(1,LINE),IN).EQ.0.0.OR.NOHE.EQ.1) GO TO 156
```

```
C
      WRITE (6,192)
C
      LNT=LNT+1
C
156   WRITE (6,199) GEN(1,LINE),GEN(2,LINE),(TITLE(KX,LINE),KX=1,5),(SCH
     1D(KX,LINE),KX=1,11),STAT(LINE),(COMENT(KX,LINE),KX=1,1),RSP(LINE)
C
      CALL OPRINT (STAT(LINE),IZAM)
C
      LNT=LNT+1
      GO TO 159
C             LOGICAL STATEMENT FOLLOWS
157   IF (AND(GEN(1,LINE),IN).EQ.0.0.OR.NOHE.EQ.1) GO TO 158
C
      WRITE (6,192)
C
      LNT=LNT+1
C
158   WRITE (6,200) GEN(1,LINE),GEN(2,LINE),(TITLE(KX,LINE),KX=1,5),(SCH
     1D(KX,LINE),KX=1,11),STAT(LINE),(COMENT(KX,LINE),KX=1,1),RSP(LINE)
C
      CALL OPRINT (STAT(LINE),IZAM)
C
      LNT=LNT+1
159   GEN(1,LINE)=TEMX1
      GEN(2,LINE)=TEMX2
160   LINE=LINE+1
C
      KSET=3
      CALL FLAG (MAINL,MASUM,MANL,CODE,LINE,MANOUT,KEND,KGT,KSET)
      IF(KGT.EQ.1) GO TO 134
      IF (RSP(LINE).EQ.TOT.AND.MANOUT.EQ.0) GO TO 162
      IF (LNT.LT.47) GO TO 135
C             LOGICAL STATEMENT FOLLOWS
161   IF (AND(GEN(1,LINE),MSK(1,1)).NE.AND(GEN(1,LINE-1),MSK(1,1)).OR.MA
     1NOUT.EQ.1.OR.KEND.GT.0) GO TO 162
C             LOGICAL STATEMENT FOLLOWS
      GOX=AND(GEN(1,LINE),MSK(1,1))
C
      WRITE (6,202) GOX,(HEAD3(KPX),KPX=1,11)
C
162   WRITE (6,201) (DASH,KPX=1,22),(HEAD2(KPX),KPX=1,11),(XLGND(KPX),KP
     1X=1,42)
C
      GO TO 133
C
163   WRITE (6,201) (DASH,KPX=1,22),(HEAD2(KPX),KPX=1,11),(XLGND(KPX),KP
     1X=1,42)
C
      IF (KEND.LE.0) GO TO 164
      KEND=0
      GO TO 132
164   KIX=6
      GEX1=0
      MAN=1
      MANOUT=1
C
C BY-MAN CARDS (CARDS 19), AND FINAL PROGRAM DECK ASTERISK CARD(CARD 20)
      READ (5,203) MANL,XMAN(1)
```

```
C
      IF (KPUNCH.GT.0) PUNCH 203, MANL,XMAN(1)
C
      IF (MANL.NE.AST) GO TO 165
      IF (KTI.EQ.1) KSA=1
C
      IF (KSA.EQ.0) WRITE (6,204) BLANK
C
      GO TO 101
165   JMAN=1
      GO TO 132
C
C
C
166   FORMAT (13A6,A2)
167   FORMAT (1X,21A6,A5/114HOTHIS IS *MAPS-II* (MANAGEMENT ANALYSIS AND
     1 PLANNING SYSTEM).  FOR USER INFORMATION SEE DON PACKE OR GIL RAFF
     2AELI./1X,A6)
168   FORMAT (3A2,A1,A6,8X,A6,4X,A2,4A2)
169   FORMAT (9X,12HCONTROL CARD/1X,30H------------------------------/1X
     1,7HCOLUMNS,5X,5HINPUT,6X,7HOPTIONS/1X,7H-------,5X,5H-----,6X,7H--
     2-----/4X,3H1,2,9X,A2,6X,102HLOCATES THE VERTICAL ASTERISK CURSOR C
     3OLUMN (01 THRU 66) IN THE SCHEDULE FIELD. BLANK ELIMINATES THE */6
     4X,1H4,9X,A2,6X,103HBLANK GIVES TOTAL LISTING. ONE(1)GIVES TOTAL LI
     5STING + SUMMARY LISTING.                                /6X,1H6,9X
     6,A2,6X,92HBLANK GIVES SLASH(/) AND NEED DATE OVERPRINT IN THE SCHE
     7DULE FIELD. ONE (1) SUPPRESSES THEM.)
170   FORMAT (6X,1H7,5X,5X,A1,6X,30HNEED DATE SYMBOL. BLANK GIVES ,A1,66
     1H. NON BLANK GIVES THE ACTUAL CHARACTER PUNCHED ON THE CONTROL CAR
     2D/3X,4H   8,5X,1H ,A4,1H),6X,84HTOTAL LISTING MASK(MATCHED WITH CO
     3LUMNS 51 THRU 54 ON THE ID CARD). BLANK ASSUMES 2./2X,5H10,11,9X,A
     42,6X,83HID FLAG COLUMN NUMBER (51-54) WHICH IS TO BE MATCHED WITH
     5MASKS.  BLANK ASSUMES 51./2X,5H   22,5X,1H ,A4,1H),6X,87HSUMMARY L
     6ISTING MASK (MATCHED WITH COLUMNS 51 THRU 54 ON THE ID CARD). BLAN
     7K ASSUMES 4.)
171   FORMAT (2X,5H32,33,5X,4X,A2,6X,87HSUPRESSES THE PRINTING OF HIERAR
     1CHY NUMBERS THAT ARE EQUAL TO OR LESS THAN THIS NUMBER./5X,2H35,9X
     2,A2,6X,103HONE(1) GIVES NEW PROGRAM DECK SORTED IN ORDER WITH THE
     3DATE PUNCHED ON THE * CARDS. BLANK GIVES NO DECK/5X,2H37,9X,A2,6X,
     489HBLANK PERMITS THE PRINTING OF SUMMARY INFORMATION BETWEEN PROGR
     5AMS. ONE(1) SUPPRESSES IT./5X,2H41,9X,A2,6X,93HBLANK PERMITS THE P
     6RINTING OF HIERARCHY ERROR MESSAGES WITHIN THE TEXT. ONE(1) SUPPRE
     7SSES IT.)
172   FORMAT (11A6/11A6/11A6)
173   FORMAT (13A6,A2/6A6,A4,6A6,A4/13A6,A2)
174   FORMAT (12HOERROR CARDS)
175   FORMAT (A1,A1,A5,A4,A1,5A6,A1,A6,A1,A4,A1,A3,A1,3A6,A3)
176   FORMAT (39H THIS CARD IN ID DECK IS NOT ID FORMAT(,A1,A1,A5,A4,A1,
     15A6,A1,A6,A1,A4,A1,A3,A1,3A6,A3,1H))
177   FORMAT (54HOMORE THAN 1000 VALID ID CARDS--PROGRAM IGNORES EXCESS)
178   FORMAT (A1)
179   FORMAT (1H )
180   FORMAT (11A6,A2,A1,A5,A4,A2)
181   FORMAT (39H NO ID CARD FOR THIS SCHEDULE CARD    (11A6,A2,A1,A5,A4
     1,A2,1H))
182   FORMAT (A5,A4,A5,A3,A5,9A6,A4)
183   FORMAT (39H NO ID CARD FOR THIS STATUS CARD      (,A5,A4,A5,A3,A5,
     19A6,A4,1H))
184   FORMAT (36HONO ERROR CARDS IN FOLLOWING PROGRAM/1H A1)
185   FORMAT (24HLRESPONSIBLE PERSON LIST/(15(1X,A6)))
```

```
186   FORMAT (1HL,I4,40H VALID ID CARDS READ--PROGRAM MAX =1000 )           MAPS  660
187   FORMAT (1HO,I5,17H HIERARCHY ERRORS)                                  MAPS  661
188   FORMAT (1H1/1X,13A6,A2)                                               MAPS  662
189   FORMAT (31HORESPONSIBILITY BY MAN FOR *** ,A6,4H ***,6X,8HMASK =      MAPS  663
     1,A4,1H))                                                              MAPS  664
190   FORMAT (11HOHIERARCHY ,38X,11A6,10X,7H.PERSON/8H  NUMBER,13X,11HDE    MAPS  665
     1SCRIPTION,17X,11A6,17H  COMMENT .RSPBLE/1H ,21A6,A5)                  MAPS  666
191   FORMAT (2(49X,11A6/),6X,6A6,7X,11A6/9X,5A6,10X,11A6/6X,6A6,7X,11A6    MAPS  667
     1)                                                                     MAPS  668
192   FORMAT (1X,8X,17H*HIERARCHY ERROR*,/)                                 MAPS  669
193   FORMAT (49X,11A6/49X,11A6)                                            MAPS  670
194   FORMAT (1X,A2,2X,5A6,14X,11A6,A4,A6,1X,A6)                            MAPS  671
195   FORMAT (5X,5A6,14X,11A6)                                              MAPS  672
196   FORMAT (1X,A3,3X,5A6,12X,11A6,A4,A6,1X,A6)                            MAPS  673
197   FORMAT (1X,A5,4X,5A6,9X,11A6,A4,A6,1X,A6)                             MAPS  674
198   FORMAT (1X,A5,A1,6X,5A6,6X,11A6,A4,A6,1X,A6)                          MAPS  675
199   FORMAT (1X,A5,A3,7X,5A6,3X,11A6,A4,A6,1X,A6)                          MAPS  676
200   FORMAT (1X,A5,A4,9X,5A6,11A6,A4,A6,1X,A6)                             MAPS  677
201   FORMAT (1X,21A6,A5/49X,11A6/10HOLEGEND.  ,13A6,A2,6A6,A4/10H .....    MAPS  678
     1..  ,6A6,A4,13A6,A2)                                                  MAPS  679
202   FORMAT (7H (ITEM ,A2,21H CONTINUED NEXT PAGE),19X,11A6)               MAPS  680
203   FORMAT (A6,1X,A6)                                                     MAPS  681
204   FORMAT (1H1,A1)                                                       MAPS  682
      END                                                                   MAPS  683
```

```
$IBMAP DATE     DECK                                                        DATE     1
       ENTRY    DATE                                                        DATE     2
DATE   SAVE     4                                                           DATE     3
       DLD      .JDATE+1                                                    DATE     4
       DST*     3,4                                                         DATE     5
       RETURN   DATE                                                        DATE     6
       END                                                                  DATE     7
```

```
$IBFTC FLAG    DECK
      SUBROUTINE FLAG (MAINL,MASUM,MANL,CODE,LINE,MANOUT,KEND,KGT,KSET)
C
C THE FLAG SUBROUTINE IS USED FOR THE SELECTIVE PRINTOUT OPTIONS OF
C MAPS.  THE SUBROUTINE IS ORGANIZED INTO THREE MAIN SECTIONS.
C THE FIRST ASSIGNS THE TOTAL AND SUMMARY LISTING MASKS, AND THE ID CARD
C FLAG COLUMN.  THE SECOND SECTION ASSIGNS THE BY-MAN MASK.
C THE THIRD SELECTS ITEMS TO BE PRINTED ACCORDING TO THE LISTING BEING
C PROCESSED.
C
      DATA SL,TMS/6H0(0000,0000000000077/
      DATA BLANK,ONE,TWO,FOUR,(F(J),J=1,4),ZERO/6H0000   ,6H000001,6H0000
     102,6H000004,6H000051,6H000052,6H000053,6H000054,6H000000/
      DIMENSION CODE(1), F(4)
      REAL MAINL,MASUM,MANL
C
      IF (KSET.EQ.3) GO TO 304
      IF (KSET.EQ.2) GO TO 303
C            LOGICAL STATEMENT FOLLOWS
      TMSK1=ARS(30,MAINL)
C            LOGICAL STATEMENT FOLLOWS
      TMSK2=ARS(30,MASUM)
C            LOGICAL STATEMENT FOLLOWS
      FLGCL=ARS(24,ALS(12,MAINL))
C            LOGICAL STATEMENT FOLLOWS
      IF (TMSK1.EQ.ARS(6,BLANK)) TMSK1=TWO
C            LOGICAL STATEMENT FOLLOWS
      IF (TMSK2.EQ.ARS(6,BLANK)) TMSK2=FOUR
      IF (FLGCL.EQ.BLANK) FLGCL=F(1)
      DO 301 K=1,4
301   IF (FLGCL.EQ.F(K)) GO TO 302
      K=1
C            LOGICAL STATEMENT FOLLOWS
302   MAINL=OR(SL,OR(ALS(30,TMSK1),ALS(12,F(K))))
C            LOGICAL STATEMENT FOLLOWS
      MASUM=OR(SL,OR(ALS(30,TMSK2),ALS(12,F(K))))
      L=36-6*K
C            LOGICAL STATEMENT FOLLOWS
      TMSK1=ALS(L,TMSK1)
C            LOGICAL STATEMENT FOLLOWS
      TMSK2=ALS(L,TMSK2)
C            LOGICAL STATEMENT FOLLOWS
      BNK=ALS(L,ARS(6,BLANK))
C            LOGICAL STATEMENT FOLLOWS
      TMX=ALS(L,TMS)
      RETURN
C            LOGICAL STATEMENT FOLLOWS
303   TMSK3=ARS(30,MANL)
C            LOGICAL STATEMENT FOLLOWS
      IF (TMSK3.EQ.ARS(6,BLANK)) TMSK3=ONE
C            LOGICAL STATEMENT FOLLOWS
      MANL=OR(SL,OR(ALS(30,TMSK3),ALS(12,F(K))))
C            LOGICAL STATEMENT FOLLOWS
      TMSK3=ALS(L,TMSK3)
      RETURN
C            LOGICAL STATEMENT FOLLOWS
304   TEMP=AND(CODE(LINE),TMX)
C            LOGICAL STATEMENT FOLLOWS
      IF (KEND.GT.0.AND.(TEMP.EQ.BNK.OR.AND(TEMP,TMSK2).EQ.ZERO)) GO TO
     1306
      IF (KEND.GT.0) GO TO 305
C            LOGICAL STATEMENT FOLLOWS
      IF (MANOUT.EQ.0.AND.TEMP.NE.BNK.AND.AND(TEMP,TMSK1).EQ.ZERO) GO TO
     1 306
C            LOGICAL STATEMENT FOLLOWS
      IF (MANOUT.EQ.1.AND.TEMP.NE.BNK.AND.AND(TEMP,TMSK3).EQ.ZERO) GO TO
     1 306
305   KGT=2
      RETURN
306   KGT=1
      RETURN
      END
```

```
$IBFTC SORTER  DECK
      SUBROUTINE SORTER (KXM)
C
C  SUBROUTINE SORTER SORTS IN ORDER BY RIPPLING THROUGH THE DECK IN
C  BOTH DIRECTIONS AND EXCHANGING ADJACENT CARDS IF THEY ARE OUT
C  OF ORDER
C
      DATA ASK1,ASK2,ZERO/6H00C00 ,6H0000  ,6H000000/
      COMMON N,GEN,SKED,L1,K1,TITLE,PERS,X,WKS,STAT,IXT
      DIMENSION GEN(2,1000), TITLE(5,1000), SKED(11,1000), WKS(1000), ST
     1AT(1,1000), PERS(1000), X(1000), IXT(1001)
      DIMENSION TEMP(6), ITST(11,1000)
      EQUIVALENCE (ITST,SKED)
C
C
      DO 403 J=1,N
C             LOGICAL STATEMENT FOLLOWS
      TEMP(1)=ARS(24,GEN(1,J))
C             LOGICAL STATEMENT FOLLOWS
      TEMP(4)=ARS(30,ALS(12,GEN(1,J)))
C             LOGICAL STATEMENT FOLLOWS
      TEMP(2)=ARS(24,ALS(18,GEN(1,J)))
C             LOGICAL STATEMENT FOLLOWS
      TEMP(5)=ARS(30,GEN(2,J))
C             LOGICAL STATEMENT FOLLOWS
      TEMP(3)=ARS(24,ALS(6,GEN(2,J)))
C             LOGICAL STATEMENT FOLLOWS
      TEMP(6)=ARS(30,ALS(18,GEN(2,J)))
      DO 401 K=1,3
      IF (TEMP(K).EQ.ASK2) TEMP(K)=ZERO
401   CONTINUE
      DO 402 K=4,6
      IF (TEMP(K).EQ.ASK1) TEMP(K)=ZERO
402   CONTINUE
C             LOGICAL STATEMENT FOLLOWS
      SKED(1,J)=OR(ALS(12,OR(ALS(6,TEMP(1)),TEMP(4))),TEMP(2))
C             LOGICAL STATEMENT FOLLOWS
403   SKED(2,J)=OR(ALS(6,OR(ALS(12,TEMP(5)),TEMP(3))),TEMP(6))
      KXX=1
      N1=N-1
404   DO 411  JY=1,2
      KOUNT=0
      DO 410  JX=1,N1
      J=JX
      IF (JY.EQ.2) J=N-JX
      IF (ITST(1,J+1)-ITST(1,J)) 406,405,410
405   IF (ITST(2,J+1)-ITST(2,J)) 406,410,410
406   TEMP1=GEN(1,J+1)
      TEMP2=GEN(2,J+1)
      DO 407  J1=1,5
407   TEMP(J1)=TITLE(J1,J+1)
      TEMP3=PERS(J+1)
      TEMP4=X(J+1)
      TEMP5=SKED(1,J+1)
      TEMP6=SKED(2,J+1)
      TEMP7=STAT(1,J+1)
      TEMP8=WKS(J+1)
      ITMP=IXT(J+1)
      GEN(1,J+1)=GEN(1,J)
      GEN(2,J+1)=GEN(2,J)                                               SORTE  60
      DO 408 J1=1,5                                                     SORTE  61
408   TITLE(J1,J+1)=TITLE(J1,J)                                         SORTE  62
      PERS(J+1)=PERS(J)                                                 SORTE  63
      X(J+1)=X(J)                                                       SORTE  64
      SKED(1,J+1)=SKED(1,J)                                             SORTE  65
      SKED(2,J+1)=SKED(2,J)                                             SORTE  66
      STAT(1,J+1)=STAT(1,J)                                             SORTE  67
      WKS(J+1)=WKS(J)                                                   SORTE  68
      IXT(J+1)=IXT(J)                                                   SORTE  69
      GEN(1,J)=TEMP1                                                    SORTE  70
      GEN(2,J)=TEMP2                                                    SORTE  71
      DO 409 J1=1,5                                                     SORTE  72
409   TITLE(J1,J)=TEMP(J1)                                              SORTE  73
      PERS(J)=TEMP3                                                     SORTE  74
      X(J)=TEMP4                                                        SORTE  75
      SKED(1,J)=TEMP5                                                   SORTE  76
      SKED(2,J)=TEMP6                                                   SORTE  77
      STAT(1,J)=TEMP7                                                   SORTE  78
      WKS(J)=TEMP8                                                      SORTE  79
      IXT(J)=ITMP                                                       SORTE  80
      KOUNT=1                                                           SORTE  81
410   CONTINUE                                                          SORTE  82
      IF (KOUNT.EQ.0) RETURN                                            SORTE  83
      KXX=KXX+1                                                         SORTE  84
      IF (KXX.GE.N) RETURN                                              SORTE  85
411   CONTINUE                                                          SORTE  86
      GO TO 404                                                         SORTE  87
      END                                                               SORTE  88
```

```
$IBFTC CHECK    DECK
      SUBROUTINE CHECK (KZX)
C
C  SUBROUTINE CHECK CHECKS THE SORTED ID DECK FOR HIERARCHY ERRORS
C
      DATA IN/000000000001/
      DATA LKB1/000000006060/,LKB2/000000000060/
      DIMENSION GEN(2,1000), SCH(11,1000), TAG(1001)
      EQUIVALENCE (SCH(1,1),TAG(1)), (XIN,IN)
      COMMON NUMBER,GEN,SCH,LINE,KOLUMN
      INTEGER TAG
C     .
C
      KZX=0
      DO 522 JCTR=1,5
      DO 509 KCTR=1,NUMBER
      GO TO (501,501,501,502,502),JCTR
C            LOGICAL STATEMENT FOLLOWS
501   LT=IARS(6,GEN(1,KCTR)) .
      GO TO (503,504,505,505,505),JCTR
C            LOGICAL STATEMENT FOLLOWS
502   LT=IARS(12,GEN(2,KCTR))
      GO TO (506,506,506,506,507),JCTR
C            LOGICAL STATEMENT FOLLOWS
503   TAG(KCTR)=IARS(18,LT)
      GO TO 508
C            LOGICAL STATEMENT FOLLOWS
504   TAG(KCTR)=IARS(30,IALS(30,IARS(12,LT)))
      GO TO 508
C            LOGICAL STATEMENT FOLLOWS
505   TAG(KCTR)=IARS(24,IALS(24,LT))
      GO TO 508
C            LOGICAL STATEMENT FOLLOWS
506   TAG(KCTR)=IARS(18,LT)
      GO TO 508
C            LOGICAL STATEMENT FOLLOWS
507   TAG(KCTR)=IARS(24,IALS(24,IARS(6,LT)))
508   CONTINUE
509   CONTINUE
      DO 510 LCTR=1,NUMBER
      IF (TAG(LCTR).EQ.LKB1.OR.TAG(LCTR).EQ.LKB2) GO TO 510
      GO TO 511
510   CONTINUE
511   CONTINUE
512   IW=0
C            LOGICAL STATEMENT FOLLOWS
      L=IARS(6,GEN(1,LCTR))
C            LOGICAL STATEMENT FOLLOWS
      M=IARS(12,GEN(2,LCTR))
      GO TO (513,514,515,516,517),JCTR
C            LOGICAL STATEMENT FOLLOWS
513   JC=IARS(30,IALS(30,IARS(12,L)))
      IF (JC.EQ.LKB1.OR.JC.EQ.LKB2) GO TO 514
      IW=1
C            LOGICAL STATEMENT FOLLOWS
514   JC=IARS(24,IALS(24,L))
      IF (JC.EQ.LKB1.OR.JC.EQ.LKB2) GO TO 515
      IW=1
C            LOGICAL STATEMENT FOLLOWS
```

```
515     JC=IARS(18,M)                                                               CHECK  60
        IF (JC.EQ.LKB1.OR.JC.EQ.LKB2) GO TO 516                                     CHECK  61
        IW=1                                                                        CHECK  62
C                LOGICAL STATEMENT FOLLOWS                                          CHECK  63
516     JC=IARS(24,IALS(24,IARS(6,M)))                                              CHECK  64
        IF (JC.EQ.LKB1.OR.JC.EQ.LKB2) GO TO 517                                     CHECK  65
        IW=1                                                                        CHECK  66
C                LOGICAL STATEMENT FOLLOWS                                          CHECK  67
517     JC=IARS(30,IALS(30,M))                                                      CHECK  68
        IF (JC.EQ.LKB1.OR.JC.EQ.LKB2) GO TO 518                                     CHECK  69
        IW=1                                                                        CHECK  70
518     CONTINUE                                                                    CHECK  71
C                LOGICAL STATEMENT FOLLOWS                                          CHECK  72
        IF (IW.EQ.1) GEN(1,LCTR)=OR(GEN(1,LCTR),IN)                                 CHECK  73
        IF (LCTR.EQ.NUMBER) GO TO 522                                               CHECK  74
        J=LCTR+1                                                                    CHECK  75
519     IF (TAG(LCTR)-TAG(J)) 521,520,521                                           CHECK  76
520     IF (J.EQ.NUMBER) GO TO 522                                                  CHECK  77
        J=J+1                                                                       CHECK  78
        GO TO 519                                                                   CHECK  79
521     LCTR=J                                                                      CHECK  80
        GO TO 512                                                                   CHECK  81
522     CONTINUE                                                                    CHECK  82
        DO 523 JX=1,NUMBER                                                          CHECK  83
C                LOGICAL STATEMENT FOLLOWS                                          CHECK  84
523     IF (AND(GEN(1,JX),IN).EQ.XIN) KZX=KZX+1                                     CHECK  85
        RETURN                                                                      CHECK  86
        END                                                                         CHECK  87
```

```
$IBFTC PUNOUT  DECK
      SUBROUTINE PUNOUT
C
C  THE PUNOUT SUBROUTINE PUNCHES A NEW DATA DECK INCLUDING ID,SCHEDULE,
C  AND STATUS CARDS
C
      DATA BLK/6H  0000/
      DATA AST,PER/6H*00000,6H.00000/
      DATA BLANK/1H /
      DATA TAST/6H   *00/
      DATA TXQ/0000000000002/
      COMMON N,GEN,SKED,L1,K1,TITLE,PERS,X,WKS,STAT
      DIMENSION TEMP(66), DA(2)
      DIMENSION GEN(2,1000), TITLE(5,1000), SKED(11,1000), WKS(1000), ST
     1AT(1,1000), PERS(1000), X(1000)
C
C
C     SUBROUTINE DATE IS USED TO EXTRACT THE PROGRAM RUN DATE FROM
C THE COMPUTER CLOCK.  AT LEWIS IT IS WRITTEN IN IBM MAP LANGUAGE.
C IT COMPOSES AN EIGHT CHARACTER DATE (E.G. 11/24/71 ) INTO TWO
C HOLLERITH WORDS.
      CALL DATE (DA)
      DO 601 J=1,N
C
601   PUNCH 610, GEN(1,J),GEN(2,J),(TITLE(K,J),K=1,5),PERS(J),X(J)
C
      PUNCH 609, DA
C
      DO 606 J=1,N
C             LOGICAL STATEMENT FOLLOWS
      IF (AND(GEN(1,J),TXQ).NE.TXQ) GO TO 606
      DO 602 M=1,11
      JM=6*M-5
C             LOGICAL STATEMENT FOLLOWS
      TEMP(JM)=ALS(30,ARS(30,SKED(M,J)))
C             LOGICAL STATEMENT FOLLOWS
      TEMP(JM+1)=ALS(30,ARS(24,SKED(M,J)))
C             LOGICAL STATEMENT FOLLOWS
      TEMP(JM+2)=ALS(30,ARS(18,SKED(M,J)))
C             LOGICAL STATEMENT FOLLOWS
      TEMP(JM+3)=ALS(30,ARS(12,SKED(M,J)))
C             LOGICAL STATEMENT FOLLOWS
      TEMP(JM+4)=ALS(30,ARS(6,SKED(M,J)))
C             LOGICAL STATEMENT FOLLOWS
602   TEMP(JM+5)=ALS(30,SKED(M,J))
      DO 603 M=1,66
      IF (TEMP(M).EQ.AST) TEMP(M)=BLANK
603   CONTINUE
C             LOGICAL STATEMENT FOLLOWS
      TM=ALS(24,X(J))
      DO 604 M=1,66
      IF (TEMP(M).NE.BLANK.AND.TEMP(M).NE.AST.AND.TEMP(M).NE.PER) GO TO
     1605
604   CONTINUE
      IF (TM.NE.BLK) GO TO 605
      GO TO 606
C
605   PUNCH 611, (TEMP(M),M=1,66),TM,GEN(1,J),GEN(2,J)
C
```

```
606   CONTINUE
C
      PUNCH 608
C
      PUNCH 609, DA
C
      DO 607 J=1,N
      IF ((WKS(J).EQ.BLANK.OR.WKS.EQ.TAST).AND.STAT(1,J).EQ.BLANK) GO TO
     1 607
C
      PUNCH 512, GEN(1,J),GEN(2,J),WKS(J),STAT(1,J)
C
607   CONTINUE
C
      PUNCH 608
C
      PUNCH 609, DA
C
      RETURN
C
C
C
608   FORMAT (1H/)
609   FORMAT (1H*,5X,A6,A2,11H=PUNCH DATE)
610   FORMAT (1HS,1X,A5,A4,1X,5A6,1X,A6,1X,A4)
611   FORMAT (66A1,A2,1X,A5,A4)
612   FORMAT (A5,A4,5X,A3,5X,A6)
      END
```

```
$IBFTC PICK    DECK
      SUBROUTINE PICK (GEN,CODE,N)
C
C  SUBROUTINE PICK SELECTS ALL ID CARDS WITH A NON BLANK MASK IN
C  COLUMNS 51-54
C
      DATA BNX/0777777770000/
      DATA BLANK,BNK/1H ,6H    00/
      DIMENSION GEN(1), CODE(1), X(3,8)
C
      WRITE (6,704)
C
      DO 701 MX=1,3
      DO 701 MY=1,8
701   X(MX,MY)=BLANK
      MX=1
      DO 703 J=1,N
C             LOGICAL STATEMENT FOLLOWS
      IF (AND(CODE(J),BNX).EQ.BNK) GO TO 703
      X(1,MX)=GEN(2*J-1)
      X(2,MX)=GEN(2*J)
      X(3,MX)=CODE(J)
      MX=MX+1
      IF (MX.LT.9) GO TO 703
C
      WRITE (6,705) ((X(J1,J2),J1=1,3),J2=1,8)
C
      DO 702 MX=1,3
      DO 702 MY=1,8
702   X(MX,MY)=BLANK
      MX=1
703   CONTINUE
C
      WRITE (6,705) ((X(J1,J2),J1=1,3),J2=1,8)
C
      RETURN
C
C
C
704   FORMAT (52HLTHE FOLLOWING ID CARDS HAVE A FLAG IN COLUMNS 51-54)
705   FORMAT (3X,8(1H(,A5,A4,1H*,A4,1H)))
      END
```

```
$IBFTC OPRINT  DECK
      SUBROUTINE OPRINT (STATUS,NEXIT)
C
C  SUBROUTINE OPRINT FORMS THE SLASH AND NEED-DATE LINE FOR OVERPRINTING
C  STATUS ON THE SCHEDULE.  THE SLASH WILL NOT OVERPRINT THE SYMBOLS
C  DOT(.),ASTERISK(*),MINUS(-),AND ZERO(0)
C
      DATA IZB/000000000060/,IAST/000000000054/,IPD/000000000033/
      DATA IZQ/6H0000  /
      DATA CAS/000000007777/
      DATA IM/000000000040/,IA/000000000020/
      DATA IBLK/060000000000/,ISS/6H/      /
      DATA (ON(J),J=1,10)/000000000000,000000000001,000000000002,0000
     1C00000003,000000000004,000000000005,000000000006,000000000007,
     2000000000010,000000000011/
      DATA IDASH/6H00000-/
      INTEGER ON
      INTEGER SCH
      DIMENSION ON(11), NEXIT(2)
      DIMENSION DUMMY(6000), CODE(1000)
      DIMENSION SCH(11,1000), GEN(2,1000), JS(6), IP(66), IZ(66)
      COMMON NUMBER,GEN,SCH,LINE,KOLUMN
      COMMON DUMMY,CODE
      EQUIVALENCE (XCD,KXCD)
C
      CN(11)=ON(1)
      IF (NEXIT(1).GT.0) RETURN
      DO 801 NCT=1,66
801   IZ(NCT)=IBLK
      KOUNT=0
C            LOGICAL STATEMENT FOLLOWS
      IS=IARS(30,STATUS)
C            LOGICAL STATEMENT FOLLOWS
      IT=IARS(24,IALS(6,STATUS))
C            LOGICAL STATEMENT FOLLOWS
      IU=IARS(6,IT)
C            LOGICAL STATEMENT FOLLOWS
      IW=IARS(30,IALS(30,IT))
      IF (IS.EQ.IZB.AND.IW.EQ.IZB.AND.IU.EQ.IZB) GO TO 805
      DO 802 JCT=1,11
      IV=ON(JCT)-IU
      IF (IV.EQ.0) GO TO 803
802   CONTINUE
      GO TO 819
803   JCT=JCT-1
      DO 804 KCT=1,11
      IV=ON(KCT)-IW
      IF (IV.EQ.0) GO TO 805
804   CONTINUE
      GO TO 819
805   KCT=KCT-1
      ISL=KCT+10*JCT
      MCT=0
      DO 807 LCT=1,11
      IW=SCH(LCT,LINE)
C            LOGICAL STATEMENT FOLLOWS
      JS(1)=IARS(30,IW)
C            LOGICAL STATEMENT FOLLOWS
      JS(2)=IARS(30,IALS(6,IW))
```

```
C            LOGICAL STATEMENT FOLLOWS
      JS(3)=IARS(30,IALS(12,IW))
C            LOGICAL STATEMENT FOLLOWS
      JS(4)=IARS(30,IALS(18,IW))
C            LOGICAL STATEMENT FOLLOWS
      JS(5)=IARS(30,IALS(24,IW))
C            LOGICAL STATEMENT FOLLOWS
      JS(6)=IARS(30,IALS(30,IW))
      DO 806 NCT=1,6
      IF (JS(NCT).EQ.IZB.OR.JS(NCT).EQ.IAST.OR.JS(NCT).EQ.IDASH) JS(NCT)
     1=0
806   CONTINUE
      IP(MCT+1)=JS(1)
      IP(MCT+2)=JS(2)
      IP(MCT+3)=JS(3)
      IP(MCT+4)=JS(4)
      IP(MCT+5)=JS(5)
      IP(MCT+6)=JS(6)
      MCT=MCT+6
807   CONTINUE
      IF (IS.EQ.IZB) GO TO 814
      IF (IS-IM) 809,808,809
808   INCR=-1
      GO TO 811
809   IF (IS-IA) 819,810,819
810   INCR=1
811   CONTINUE
      IF (ISL.EQ.0) INCR=1
      JJ=KOLUMN
      JK=KOLUMN+INCR*ISL+1
      IPDS=0
812   IF (IP(JJ).EQ.IPD) IPDS=IPDS+1
      IF (JJ.EQ.JK) GO TO 813
      JJ=JJ+INCR
      GO TO 812
813   ISL=ISL+IPDS
814   CONTINUE
      IF (IS.EQ.16) GO TO 815
      IF (IS.EQ.32) GO TO 816
      NEWCOL=KOLUMN-1
      GO TO 817
815   NEWCOL=KOLUMN+ISL-1
      GO TO 817
816   NEWCOL=KOLUMN-ISL-1
817   IF (IP(NEWCOL).EQ.0) GO TO 818
      IF (IP(NEWCOL).EQ.IPD) GO TO 818
      IZ(NEWCOL)=ISS
      KOUNT=1
818   IF (NEWCOL.LE.1) GO TO 819
      NEWCOL=NEWCOL-1
      GO TO 817
C            LOGICAL STATEMENT FOLLOWS
819   XCD=AND(CAS,CODE(LINE))
      IF (KXCD.NE.IZQ) KOUNT=1
      IF (KOUNT.EQ.0) RETURN
      IF (KXCD.EQ.IZQ) GO TO 820
C            LOGICAL STATEMENT FOLLOWS
      KXCDT=IARS(6,KXCD)
C            LOGICAL STATEMENT FOLLOWS
      KXCD=KXCD-IALS(6,KXCDT)
      KXCD=KXCD+10*KXCDT
      IF (KXCD.GT.0.AND.KXCD.LT.67) IZ(KXCD)=NEXIT(2)
C
820   WRITE (6,821) IZ
C
      RETURN
C
C
C
821   FORMAT (1H+,48X,66A1)
      END
```

TABLE I. - INSTRUCTIONS FOR PUNCHING MAPS PROGRAM DECK CARDS

[Organization of the deck for these cards is shown in fig. 2.]

Card number (as in fig. 2)	Card columns	Description	FORTRAN variable name used in READ statements
		Program message card	
1	All 80 columns available for any message. This message will appear at the top of every page.		HEADNG
		Control card	
2	1,2	Locates vertical asterisk cursor column (01 to 66) in schedule field. Blank eliminates asterisk.	KOLUMN
	4	Blank gives total program listing (using total program mask in card column 8). One (1) gives total program (using total program mask) and summary listing (using summary mask in card column 22).	KEND
	6	Blank gives slash (/) and need-date overprint in sched-field. One (1) suppresses the overprint.	IZAM(1)
	7	Need date symbol. Blank gives ‡. Nonblank gives character punched in this column.	IZAM(2)
	8	Total listing mask (matched with columns 51 to 54 on ID card).	MAINL
	10, 11	Flag column number on ID card (51 to 54) which is to be matched with masks. Blank assume 51.	MAINL
	22	Summary listing mask (matched with columns 51 to 54 on ID cards).	MASUM
	32,33	Suppresses printing of hierarchy numbers equal to or less than this number (OO to ZZ).	XNPR
	35	One (1) gives a new program deck sorted in order, with date punched on asterisk cards. Blank gives no new deck.	KPUNCH
	37	Blank permits printing of summary information between programs. One (1) suppresses it.	KTI
	41	Blank permits printing of hierarchy error messages within text. One (1) suppresses it.	NOHE
		Calendar heading cards (3,4,5)	
3	1 to 66	First line of calendar heading.	HEAD1
4	1 to 66	Second line of calendar heading.	HEAD2
5	1 to 66	Position of periods (.) which are vertical columns in schedule field. (These must be period (.) or blank. Periods will supercede any other character in the schedule field.)	HEAD3
		Legend cards (6,7,8)	
6	1 to 80	First 80 characters of top line of legend.	XLGND
7	1 to 40	Last 40 characters of top line of legend.	XLGND
	41 to 80	First 40 characters of bottom line of legend.	
8	1 to 80	Last 80 characters of bottom line of legend	XLGND
		ID deck (total number of cards cannot exceed 1000)	
9	1	Columns 1 must always have an S.	ST
	3 to 11	Hierarch number. Must start in column 3.	GEN
	13 to 42	Title or description of task. Always starts in column 13.	TITLE
	44 to 49	Person or organization responsible.	RSP
	51 to 54	Flag - for special printout (see table II).	CODE
	56 to 58	Optional status. (Prints in same position on printout as columns 15, 16, 17 on status card.)	STAT
	60 to 65	Optional comments. (Prints in same position on printout as columns 23 to 28 on status card.)	COMENT

TABLE I. - Concluded. INSTRUCTIONS FOR PUNCHING MAPS PROGRAM DECK CARDS

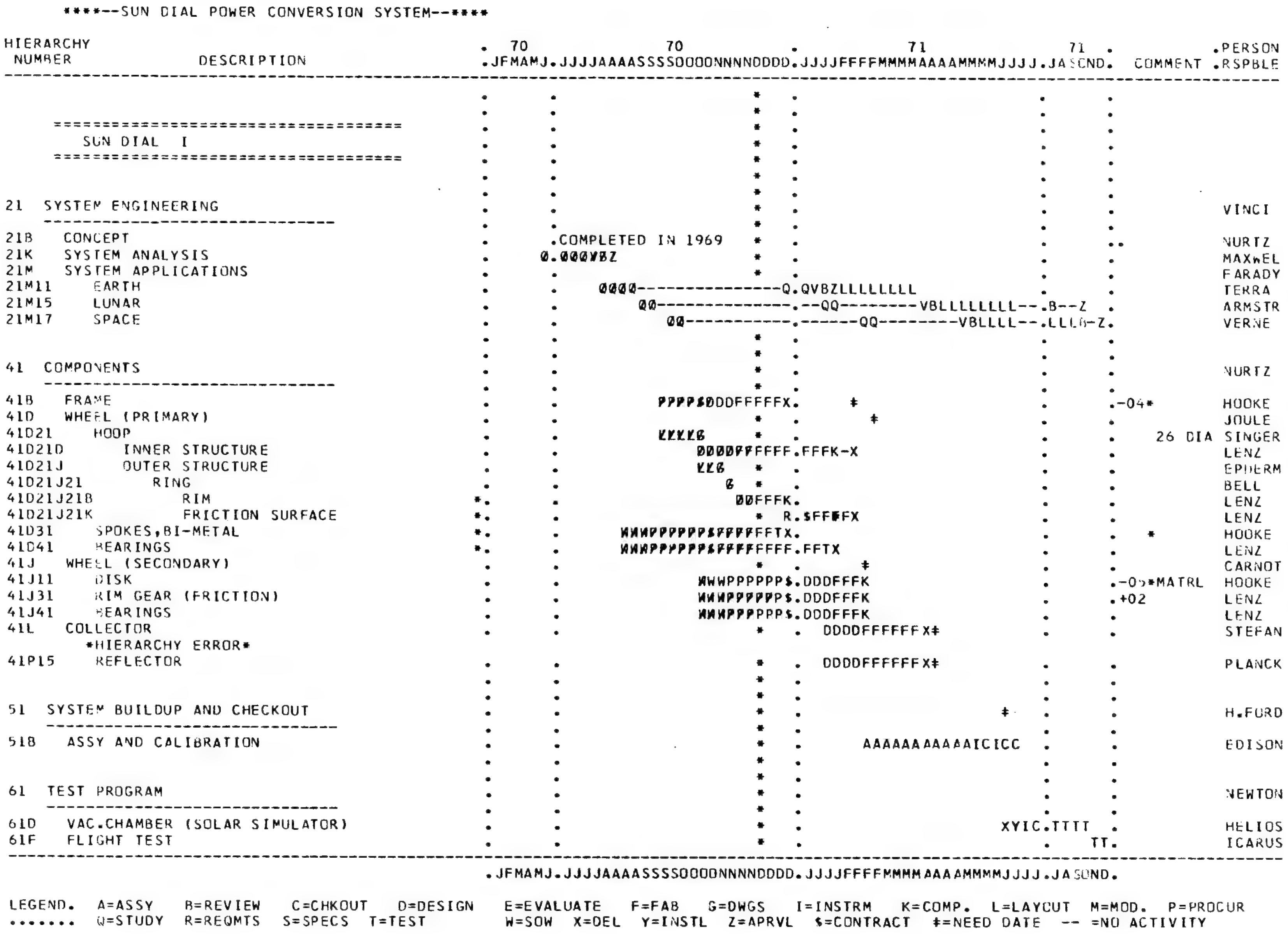
Card number	Card columns	Description	FORTRAN variable name used in READ statements
		Asterisk card	
10	1	Single asterisk card (* in column 1) must always be used at the end of the ID deck. Columns 2 to 6 must always be blank. Punch date of reproduced deck will appear on this card.	ST
		Schedule cards (Schedule deck)	
11	1 to 66 67 to 68 70 to 78	Schedule field. Any legal key punch character may be used except period (.), asterisk (*), or zero (0). Number of column in schedule field in which the need date symbol is to be printed (01 to 66). May be blank. Hierarchy number. Must start in column 70.	SKED ANEED GEN1, GEN2
		Slash card	
12	1	Slash in column 1. Columns 2 to 6 must always be blank. This card serves to separate schedule cards from schedule updated cards.	SKED(1)
		Schedule update cards	
13		Same as schedule cards (cards 11).	
		Asterisk card	
14		Same as card 10. This card must always be used even if no schedule or schedule update cards are used.	SKED(1)
		Status cards (Status deck)	
15	1 to 9 15 to 16 23 to 28	Hierarchy number. Must start in column 1. Status of form ±NN where N is a numeral 0 to 9. If any other characters or blank (except all 3 blank) are used, slash overprint will be suppressed. Comments, any legal keypunch character.	GEN1, GEN2 WKS COT1
		Slash card	
16		Same as card 12.	GEN1
		Status update cards	
17		Same as status cards (cards 15).	
		Asterisk card	
18		Same as card 10. This card must be used even if no status or status update cards are used.	GEN1
		By-man cards	
19	1 8 to 13	By-man mask (matched with columns 51 to 54 on ID cards. Name of responsible person spelled exactly as it appears in columns 44 to 49 of ID cards.	MANL XMAN(1)
		Asterisk card	
20		Same as card 10. This card must be used when running multiple program decks even if no by-man cards are used.	MANL

TABLE II. - FLAG CODE FOR SELECTIVE PRINTOUT

[P = PRINT; N = NOT PRINT.]

Flag punch (ID card columns 51 to 54)	Print combinations selected by flag punch[a]		
	Summary	Total	By-man
0	N	N	N
1	N	N	P
2	N	P	N
blank (or 3)	N	P	P
4	P	N	N
5	P	N	P
6	P	P	N
7	P	P	P

[a] Assumes use of built-in mask values: by-man = 1, total = 2, summary = 4.



```
     ****--SUN DIAL POWER CONVERSION SYSTEM--****

HIERARCHY                                        .  70              70           .           71               71 .          .PERSON
 NUMBER             DESCRIPTION                  .JFMAMJ.JJJJAAAASSSSOOOONNNNDDDD.JJJJFFFFMMMMAAAAMMMMJJJJ.JASOND.  COMMENT .RSPBLE
-----------------------------------------------------------------------------------------------------------------------------------
                                                 .      .                    *   .                        .      .
                                                 .      .                    *   .                        .      .
     =====================================       .      .                    *   .                        .      .
        SUN DIAL  I                              .      .                    *   .                        .      .
     =====================================       .      .                    *   .                        .      .
                                                 .      .                    *   .                        .      .
                                                 .      .                    *   .                        .      .
21  SYSTEM ENGINEERING                           .      .                    *   .                        .      .           VINCI
    -------------------------------              .      .                    *   .                        .      .
21B   CONCEPT                                    .      .COMPLETED IN 1969   *   .                        .      ..          NURTZ
21K   SYSTEM ANALYSIS                            .     Q.QQQVBZ              *   .                        .      .           MAXWEL
21M   SYSTEM APPLICATIONS                        .      .                    *   .                        .      .           FARADY
21M11    EARTH                                   .      .    QQQQ---------------Q.QVBZLLLLLLLL            .      .           TERRA
21M15    LUNAR                                   .      .        QQ--------------.--QQ--------VBLLLLLLLL--.B--Z  .           ARMSTR
21M17    SPACE                                   .      .           QQ-----------.------QQ--------VBLLLL--.LLLG-Z.           VERNE
                                                 .      .                    *   .                        .      .
                                                 .      .                    *   .                        .      .
41  COMPONENTS                                   .      .                    *   .                        .      .           NURTZ
    -------------------------------              .      .                    *   .                        .      .
41B   FRAME                                      .      .          PPPP$DDDFFFFFX.     ‡                  .      .-04*       HOOKE
41D   WHEEL (PRIMARY)                            .      .                    *   .       ‡                .      .           JOULE
41D21    HOOP                                    .      .          LLLLG     *   .                        .      .    26 DIA SINGER
41D21D      INNER STRUCTURE                      .      .              DDDDFFFFFF.FFFK-X                  .      .           LENZ
41D21J      OUTER STRUCTURE                      .      .              LLG   *   .                        .      .           EPIDERM
41D21J21       RING                              .      .                 G  *   .                        .      .           BELL
41D21J21B         RIM                           *.      .                  DDFFFK.                        .      .           LENZ
41D21J21K         FRICTION SURFACE              *.      .                    *  R.$FFFFX                  .      .           LENZ
41D31    SPOKES,BI-METAL                        *.      .      WWWPPPPPPP$FFFFFTX.                        .      .    *      HOOKE
41D41    BEARINGS                               *.      .      WWWPPPPPPP$FFFFFFF.FFTX                    .      .           LENZ
41J   WHEEL (SECONDARY)                          .      .                    *   .      ‡                 .      .           CARNOT
41J11    DISK                                    .      .              WWWPPPPPP$.DDDFFFK                 .      .-05*MATRL  HOOKE
41J31    RIM GEAR (FRICTION)                     .      .              WWWPPPPPP$.DDDFFFK                 .      .+02        LENZ
41J41    BEARINGS                                .      .              WWWPPPPPP$.DDDFFFK                 .      .           LENZ
41L   COLLECTOR                                  .      .                    *   .  DDDDFFFFFFX‡          .      .           STEFAN
        *HIERARCHY ERROR*
41P15    REFLECTOR                               .      .                    *   .  DDDDFFFFFFX‡          .      .           PLANCK
                                                 .      .                    *   .                        .      .
                                                 .      .                    *   .                        .      .
51  SYSTEM BUILDUP AND CHECKOUT                  .      .                    *   .                     ‡  .      .           H.FORD
    -------------------------------              .      .                    *   .                        .      .
51B   ASSY AND CALIBRATION                       .      .                    *   .      AAAAAAAAAAAICICC  .      .           EDISON
                                                 .      .                    *   .                        .      .
                                                 .      .                    *   .                        .      .
61  TEST PROGRAM                                 .      .                    *   .                        .      .           NEWTON
    -------------------------------              .      .                    *   .                        .      .
61D   VAC.CHAMBER (SOLAR SIMULATOR)              .      .                    *   .                    XYIC.TTTT  .           HELIOS
61F   FLIGHT TEST                                .      .                    *   .                        .    TT.           ICARUS
-----------------------------------------------------------------------------------------------------------------------------------
                                                 .JFMAMJ.JJJJAAAASSSSOOOONNNNDDDD.JJJJFFFFMMMMAAAAMMMMJJJJ.JASOND.

LEGEND.   A=ASSY    B=REVIEW   C=CHKOUT   D=DESIGN    E=EVALUATE   F=FAB   G=DWGS   I=INSTRM   K=COMP.   L=LAYOUT   M=MOD.   P=PROCUR
.......   Q=STUDY   R=REQMTS   S=SPECS   T=TEST       W=SOW   X=DEL   Y=INSTL   Z=APRVL   $=CONTRACT   ‡=NEED DATE   -- =NO ACTIVITY
```

Figure 1. - Example MAPS printout.

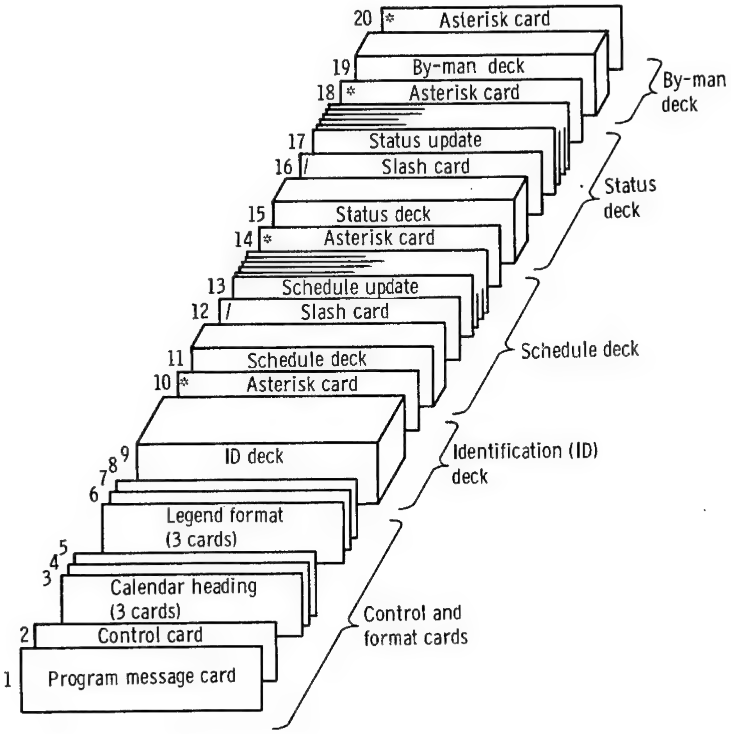
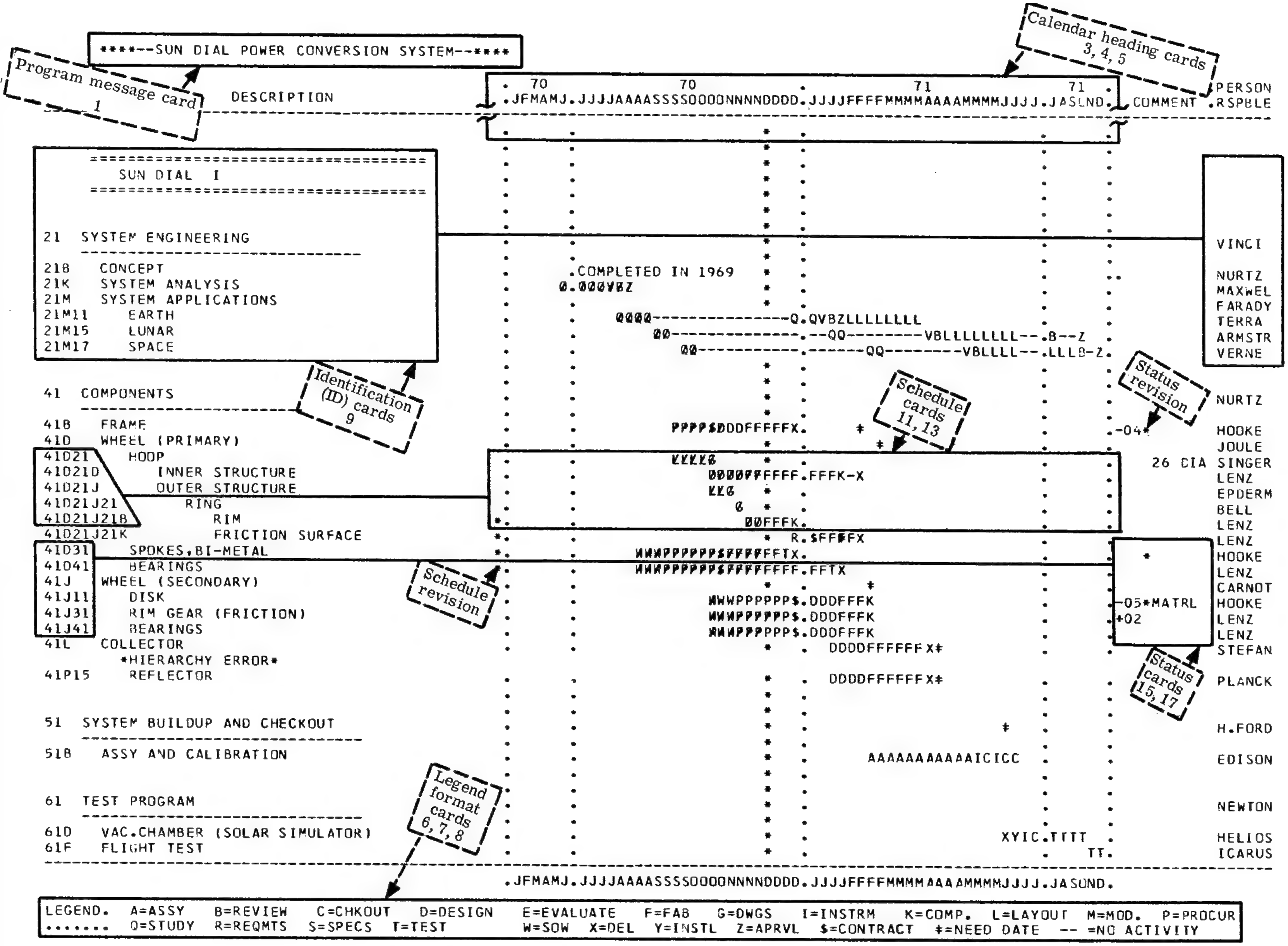
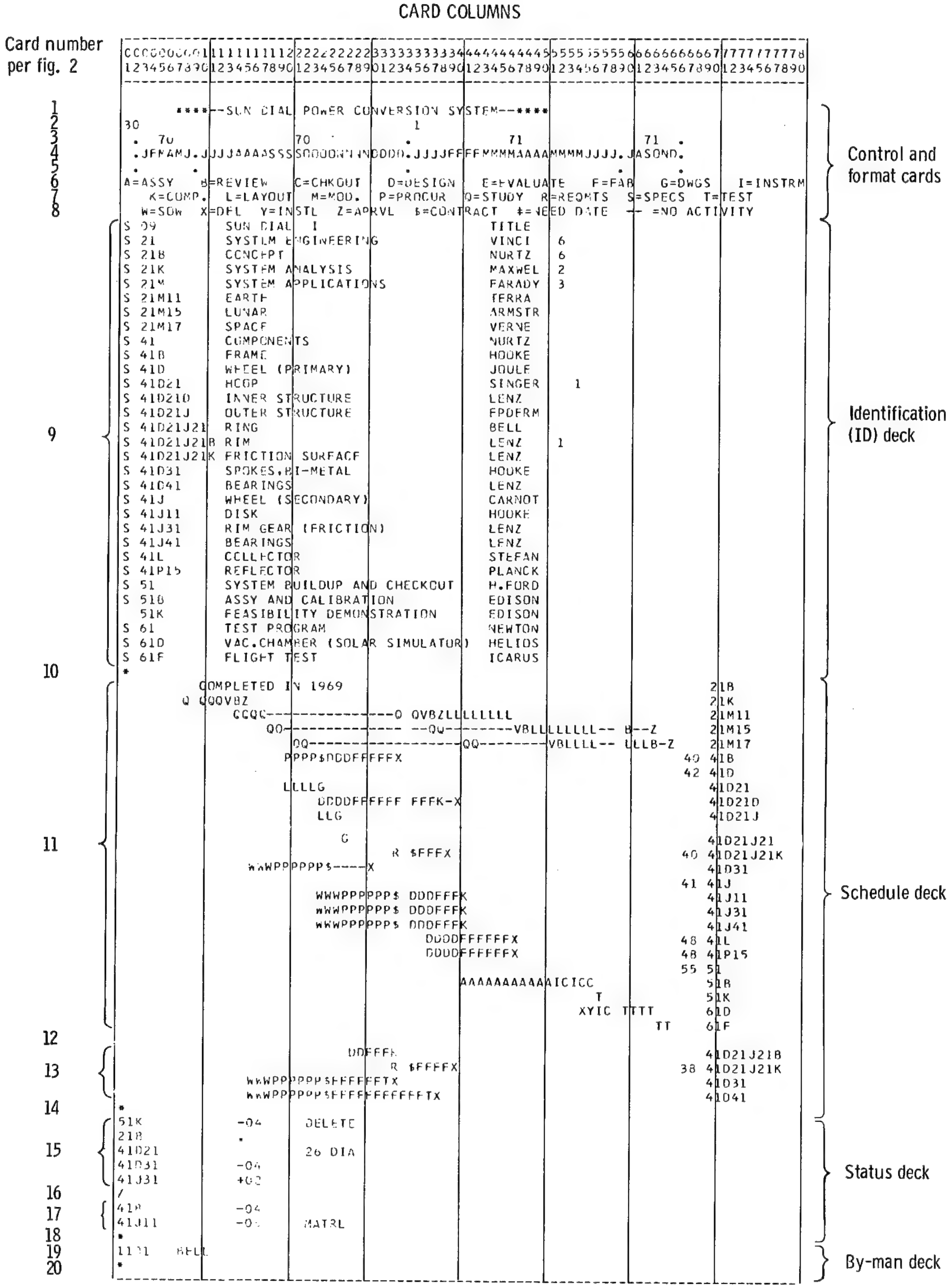


Figure 2. - Single program setup with card numbers keyed to table I and text.



```
****--SUN DIAL POWER CONVERSION SYSTEM--****

                    DESCRIPTION          .  70                70         .          71               71 .
                                         .JFMAMJ.JJJJAAAASSSSOOOONNNNDDDD.JJJJFFFFMMMMAAAAMMMMJJJJ.JASLND.  COMMENT  .PERSON
                                                                                                                     .RSPBLE
-------------------------------------------------------------------------------------------------------------------------------
    ===================================
        SUN DIAL   I
    ===================================

21   SYSTEM ENGINEERING                                                                                              VINCI
     ----------------------------------
21B    CONCEPT                                  .COMPLETED IN 1969                                                    NURTZ
21K    SYSTEM ANALYSIS                         Ø.ØØØVBZ                                                               MAXWEL
21M    SYSTEM APPLICATIONS                                                                                            FARADY
21M11     EARTH                                      ØØØØ---------------Q.QVBZLLLLLLLL                                TERRA
21M15     LUNAR                                         ØØ--------------.--QQ--------VBLLLLLLLL--.B--Z                ARMSTR
21M17     SPACE                                           ØØ------------.------QQ--------VBLLLL--.LLLB-Z.             VERNE

41   COMPONENTS                                                                                                      NURTZ
     ----------------------------------
41B    FRAME                                             PPPP$DDDFFFFFX.      ‡                          .-04*        HOOKE
41D    WHEEL (PRIMARY)                                                          ‡                                     JOULE
41D21     HOOP                                           LLLLG                                          26 CIA       SINGER
41D21D       INNER STRUCTURE                                 DDDDFFFFFF.FFFK-X                                        LENZ
41D21J       OUTER STRUCTURE                                 LLG                                                      EPDERM
41D21J21        RING                                            G                                                     BELL
41D21J21B          RIM                                          DDFFFK.                                               LENZ
41D21J21K          FRICTION SURFACE                             *  R.$FF$FX                                           LENZ
41D31     SPOKES,BI-METAL                           WWWPPPPPPP$FFFFFFTX.                         *                    HOOKE
41D41     BEARINGS                                  WWWPPPPPPP$FFFFFFFF.FFTX                                          LENZ
41J    WHEEL (SECONDARY)                                         *  .     ‡                                          CARNOT
41J11     DISK                                               WWWPPPPPPP$.DDDFFFK                        -05*MATRL     HOOKE
41J31     RIM GEAR (FRICTION)                                WWWPPPPPPP$.DDDFFFK                        +02           LENZ
41J41     BEARINGS                                           WWWPPPPPPP$.DDDFFFK                                      LENZ
41L    COLLECTOR                                                  *  .  DDDDFFFFFFX‡                                  STEFAN
       *HIERARCHY ERROR*
41P15     REFLECTOR                                               *  .  DDDDFFFFFFX‡                                  PLANCK

51   SYSTEM BUILDUP AND CHECKOUT                                                        ‡                             H.FORD
     ----------------------------------
51B    ASSY AND CALIBRATION                                              AAAAAAAAAAAICICC                             EDISON

61   TEST PROGRAM                                                                                                    NEWTON
     ----------------------------------
61D    VAC.CHAMBER (SOLAR SIMULATOR)                                                   XYIC.TTTT                     HELIOS
61F    FLIGHT TEST                                                                          TT.                      ICARUS
-------------------------------------------------------------------------------------------------------------------------------
                                           .JFMAMJ.JJJJAAAASSSSOOOONNNNDDDD.JJJJFFFFMMMMAAAAMMMMJJJJ.JASOND.
LEGEND.  A=ASSY    B=REVIEW   C=CHKOUT   D=DESIGN    E=EVALUATE   F=FAB    G=DWGS    I=INSTRM   K=COMP.  L=LAYOUT  M=MOD.  P=PROCUR
.......  O=STUDY   R=REQMTS   S=SPECS    T=TEST      W=SOW   X=DEL   Y=INSTL   Z=APRVL   $=CONTRACT  ‡=NEED DATE  -- =NO ACTIVITY
```

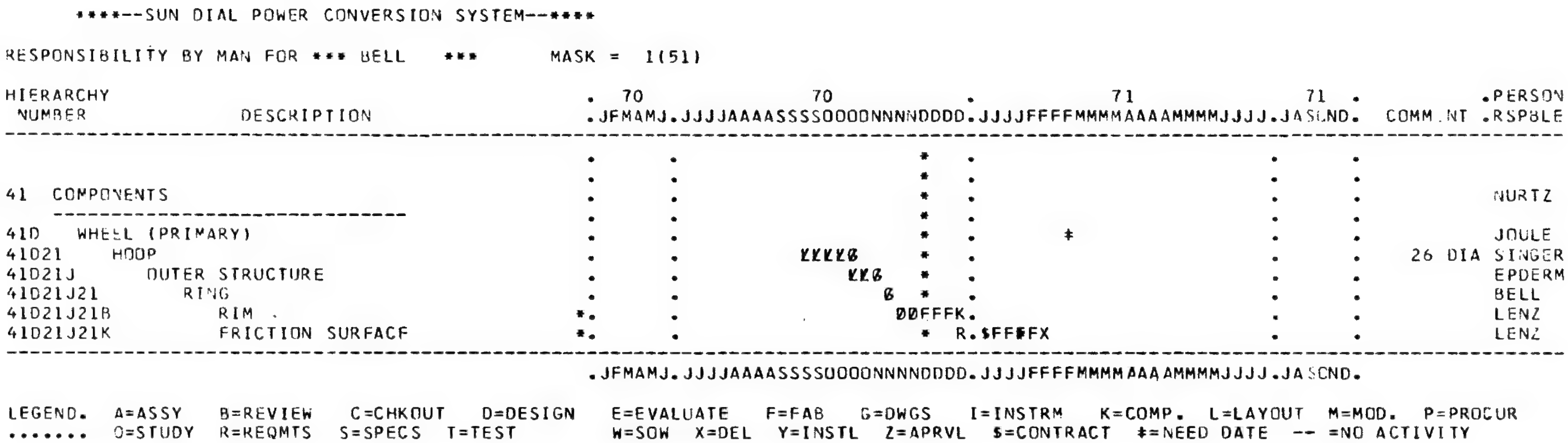
Figure 3. - Example MAPS printout showing card information locations.



CARD COLUMNS
Card number per fig. 2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Control and format cards
Identification (ID) deck
Schedule deck
Status deck
By-man deck

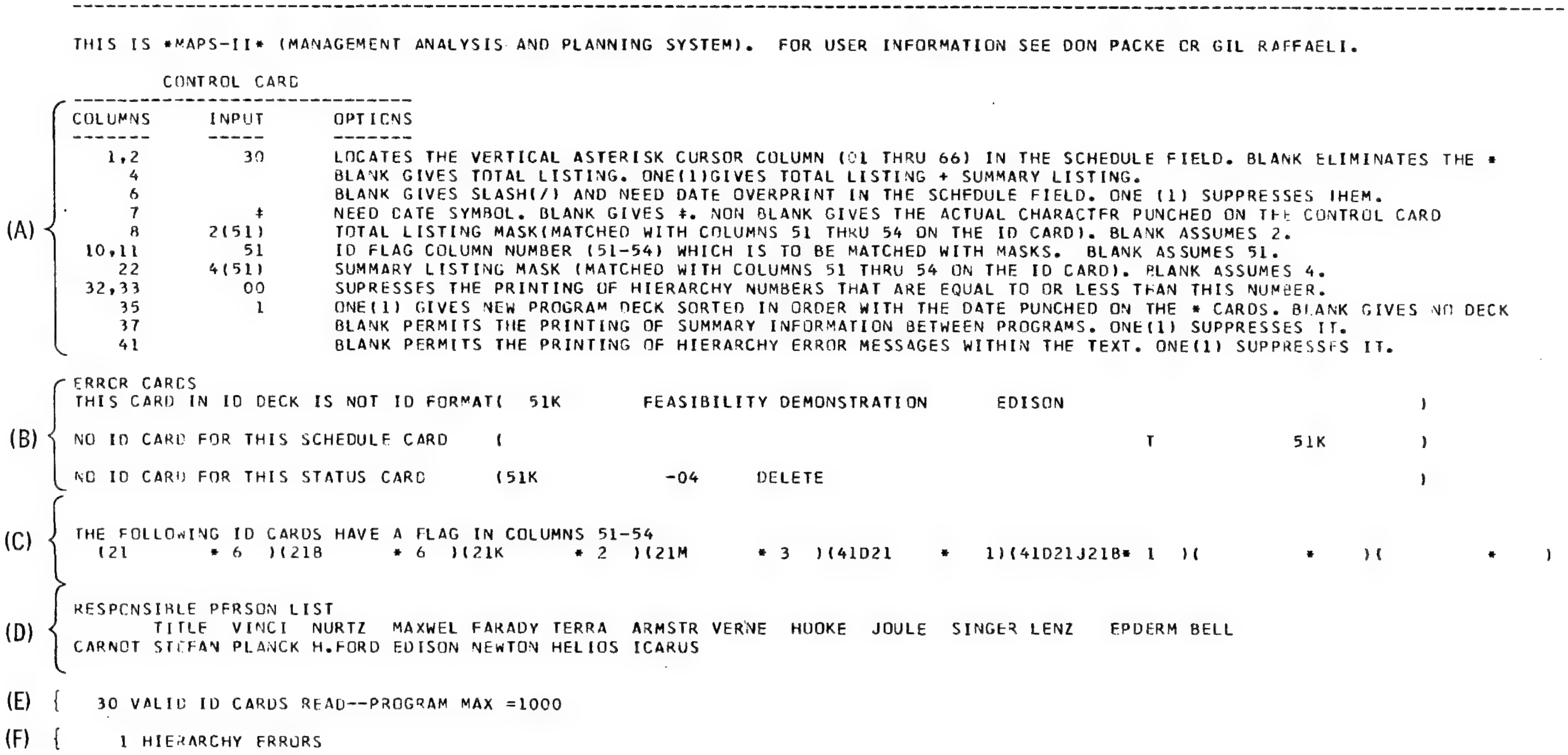
```
CCCCCCCCC11111111112222222222333333333344444444445555555555666666666677777777778
12345678901234567890123456789012345678901234567890123456789012345678901234567890

      ****--SUN DIAL POWER CONVERSION SYSTEM--****
30                                1
 .  70               70           .           71              71  .
 .JFMAMJ.JJJJAAAASSSSOOOONNNNDDDD.JJJJFFFFMMMMAAAAMMMMJJJJ.JASOND.
 .   .                            .                        .      .
A=ASSY   B=REVIEW   C=CHKOUT   D=DESIGN   E=EVALUATE   F=FAB   G=DWGS   I=INSTRM
   K=COMP.  L=LAYOUT  M=MOD.  P=PROCUR  Q=STUDY  R=REQMTS  S=SPECS  T=TEST
  W=SOW  X=DFL  Y=INSTL  Z=APRVL  $=CONTRACT  ‡=NEED DATE  -- =NO ACTIVITY
S 09        SUN DIAL  I                   TITLE
S 21        SYSTEM ENGINEERING            VINCI   6
S 21B       CONCEPT                       NURTZ   6
S 21K       SYSTEM ANALYSIS               MAXWEL  2
S 21M       SYSTEM APPLICATIONS           FARADY  3
S 21M11     EARTH                         TERRA
S 21M15     LUNAR                         ARMSTR
S 21M17     SPACE                         VERNE
S 41        COMPONENTS                    NURTZ
S 41B       FRAME                         HOOKE
S 41D       WHEEL (PRIMARY)               JOULE
S 41D21     HOOP                          SINGER    1
S 41D21D    INNER STRUCTURE               LENZ
S 41D21J    OUTER STRUCTURE               EPDERM
S 41D21J21  RING                          BELL
S 41D21J21B RIM                           LENZ    1
S 41D21J21K FRICTION SURFACE              LENZ
S 41D31     SPOKES,BI-METAL               HOOKE
S 41D41     BEARINGS                      LENZ
S 41J       WHEEL (SECONDARY)             CARNOT
S 41J11     DISK                          HOOKE
S 41J31     RIM GEAR (FRICTION)           LENZ
S 41J41     BEARINGS                      LENZ
S 41L       COLLECTOR                     STEFAN
S 41P15     REFLECTOR                     PLANCK
S 51        SYSTEM BUILDUP AND CHECKOUT   H.FORD
S 51B       ASSY AND CALIBRATION          EDISON
  51K       FEASIBILITY DEMONSTRATION     EDISON
S 61        TEST PROGRAM                  NEWTON
S 61D       VAC.CHAMBER (SOLAR SIMULATOR) HELIOS
S 61F       FLIGHT TEST                   ICARUS
*
         COMPLETED IN 1969                                                 21B
       Q QQOVBZ                                                            21K
             CCQC--------------O OVBZLLLLLLLL                              21M11
                QQ-------------- --QQ-------VBLLLLLLLLL-- B--Z             21M15
                    QQ-----------------QQ--------VBLLLL-- LLLB-Z           21M17
                   PPPP$DDDFFFFFFX                                 40 41B
                                                                   42 41D
                   LLLLG                                              41D21
                       DDDDFFFFFF FFFK-X                              41D21D
                       LLG                                            41D21J
                         G                                            41D21J21
                               R $FFFX                             40 41D21J21K
              WWWPPPPPP$----X                                         41D31
                                                                   41 41J
                      WWWPPPPPP$ DDDFFFK                              41J11
                      WWWPPPPPP$ DDDFFFK                              41J31
                      WWWPPPPPP$ DDDFFFK                              41J41
                                   DDDDFFFFFFX                     48 41L
                                   DDDDFFFFFFX                     48 41P15
                                                                   55 51
                                       AAAAAAAAAAAICICC               51B
                                                       T              51K
                                                     XYIC TTTT        61D
                                                              TT      61F

                          UDFFFF                                      41D21J21B
                               R $FFFFX                            38 41D21J21K
              WWWPPPPPP$FFFFFFFTX                                     41D31
              WWWPPPPPP$FFFFFFFFFFFFTX                                41D41
*
51K          -04     DELETE
21B          .
41D21                26 DIA
41D31        -04
41J31        +02
/
41B          -04
41J11        -04     MATRL
*
1131     BELL
*
```

Figure 4. - Listing of cards used to produce figures 1, 3, 5, and 6.



```
      ****--SUN DIAL POWER CONVERSION SYSTEM--****
RESPONSIBILITY BY MAN FOR *** BELL   ***     MASK =  1(51)
HIERARCHY                                        .   70              70          .            71              71 .          .PERSON
 NUMBER             DESCRIPTION                  .JFMAMJ.JJJJAAAASSSSOOOONNNNDDDD.JJJJFFFFMMMMAAAAMMMMJJJJ.JASOND.  COMM.NT .RSPBLE
----------------------------------------------------------------------------------------------------------------------------------
                                                 .      .                    *   .                        .      .
                                                 .      .                    *   .                        .      .
41  COMPONENTS                                   .      .                    *   .                        .      .           NURTZ
    ------------------------------               .      .                    *   .                        .      .
41D   WHEEL (PRIMARY)                            .      .                    *   .       ‡                .      .           JOULE
41D21    HOOP                                    .      .          ŁŁŁŁǤ     *   .                        .      .    26 DIA SINGER
41D21J      OUTER STRUCTURE                      .      .              ŁŁǤ   *   .                        .      .           EPDERM
41D21J21       RING                              .      .                 Ǥ  *   .                        .      .           BELL
41D21J21B         RIM                           *.      .                  ØØFFFK.                        .      .           LENZ
41D21J21K         FRICTION SURFACE              *.      .                    *  R.$FF‡FX                  .      .           LENZ
----------------------------------------------------------------------------------------------------------------------------------
                                                 .JFMAMJ.JJJJAAAASSSSOOOONNNNDDDD.JJJJFFFFMMMMAAAAMMMMJJJJ.JASCND.

LEGEND.  A=ASSY    B=REVIEW   C=CHKOUT   D=DESIGN   E=EVALUATE  F=FAB   G=DWGS    I=INSTRM  K=COMP.   L=LAYOUT  M=MOD.   P=PROCUR
.......  O=STUDY   R=REQMTS  S=SPECS  T=TEST        W=SOW  X=DEL  Y=INSTL  Z=APRVL  $=CONTRACT  ‡=NEED DATE  -- =NO ACTIVITY
```

Figure 5. - By-man excerpt listing for BELL from example MAPS printout.



```
------------------------------------------------------------------------------------------------------------------------------

THIS IS *MAPS-II* (MANAGEMENT ANALYSIS AND PLANNING SYSTEM).  FOR USER INFORMATION SEE DON PACKE OR GIL RAFFAELI.

        CONTROL CARD
------------------------------------
COLUMNS      INPUT       OPTICNS
-------      -----       -------
   1,2          30       LOCATES THE VERTICAL ASTERISK CURSOR COLUMN (01 THRU 66) IN THE SCHEDULE FIELD. BLANK ELIMINATES THE *
     4                   BLANK GIVES TOTAL LISTING. ONE(1)GIVES TOTAL LISTING + SUMMARY LISTING.
     6                   BLANK GIVES SLASH(/) AND NEED DATE OVERPRINT IN THE SCHEDULE FIELD. ONE (1) SUPPRESSES IHEM.
     7           ‡       NEED DATE SYMBOL. BLANK GIVES ‡. NON BLANK GIVES THE ACTUAL CHARACTER PUNCHED ON THE CONTROL CARD
     8       2(51)       TOTAL LISTING MASK(MATCHED WITH COLUMNS 51 THRU 54 ON THE ID CARD). BLANK ASSUMES 2.
 10,11          51       ID FLAG COLUMN NUMBER (51-54) WHICH IS TO BE MATCHED WITH MASKS.  BLANK ASSUMES 51.
    22       4(51)       SUMMARY LISTING MASK (MATCHED WITH COLUMNS 51 THRU 54 ON THE ID CARD). BLANK ASSUMES 4.
 32,33          00       SUPRESSES THE PRINTING OF HIERARCHY NUMBERS THAT ARE EQUAL TO OR LESS THAN THIS NUMBER.
    35           1       ONE(1) GIVES NEW PROGRAM DECK SORTED IN ORDER WITH THE DATE PUNCHED ON THE * CARDS. BLANK GIVES NO DECK
    37                   BLANK PERMITS THE PRINTING OF SUMMARY INFORMATION BETWEEN PROGRAMS. ONE(1) SUPPRESSES IT.
    41                   BLANK PERMITS THE PRINTING OF HIERARCHY ERROR MESSAGES WITHIN THE TEXT. ONE(1) SUPPRESSES IT.

ERRCR CARDS
THIS CARD IN ID DECK IS NOT ID FORMAT(  51K       FEASIBILITY DEMONSTRATION      EDISON                          )

NO ID CARD FOR THIS SCHEDULE CARD     (                                                  T             51K         )

NO ID CARD FOR THIS STATUS CARD       (51K           -04      DELETE                                                )


THE FOLLOWING ID CARDS HAVE A FLAG IN COLUMNS 51-54
  (21        * 6  )(218       * 6  )(21K       * 2  )(21M       * 3  )(41D21     *    1)(41D21J218* 1  )(          *    )(          *    )

RESPCNSIBLE PERSON LIST
       TITLE  VINCI  NURTZ  MAXWEL FARADY TERRA  ARMSTR VERNE  HOOKE  JOULE  SINGER LENZ   EPDERM BELL
CARNOT STEFAN PLANCK H.FORD EDISON NEWTON HELIOS ICARUS

  30 VALID ID CARDS READ--PROGRAM MAX =1000

    1 HIERARCHY ERRORS
```

Figure 6. - Special operator information.

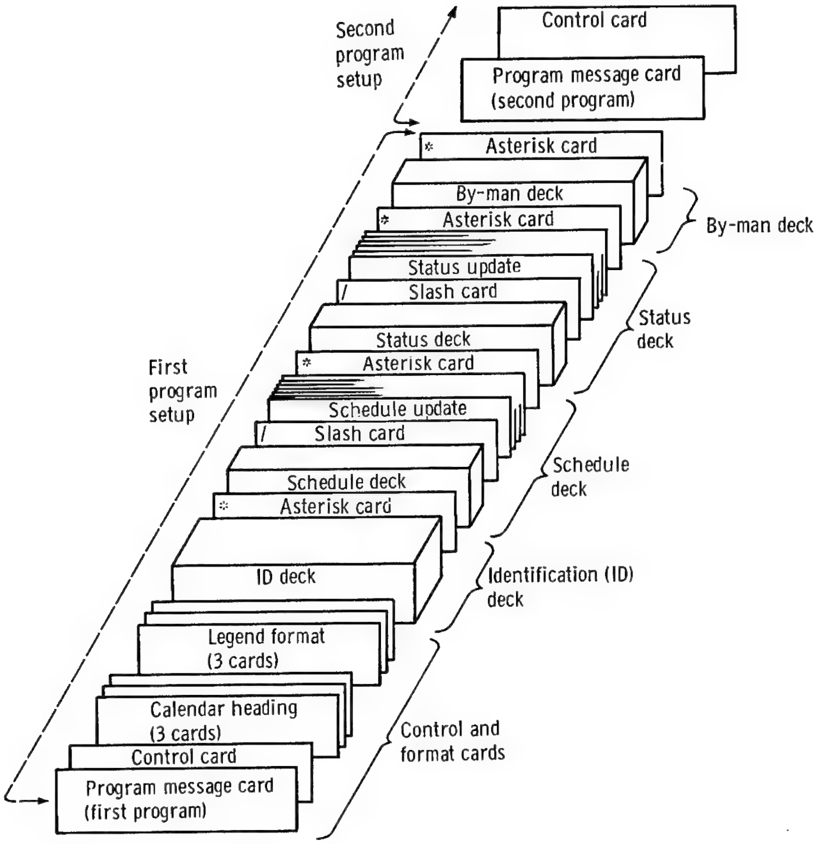
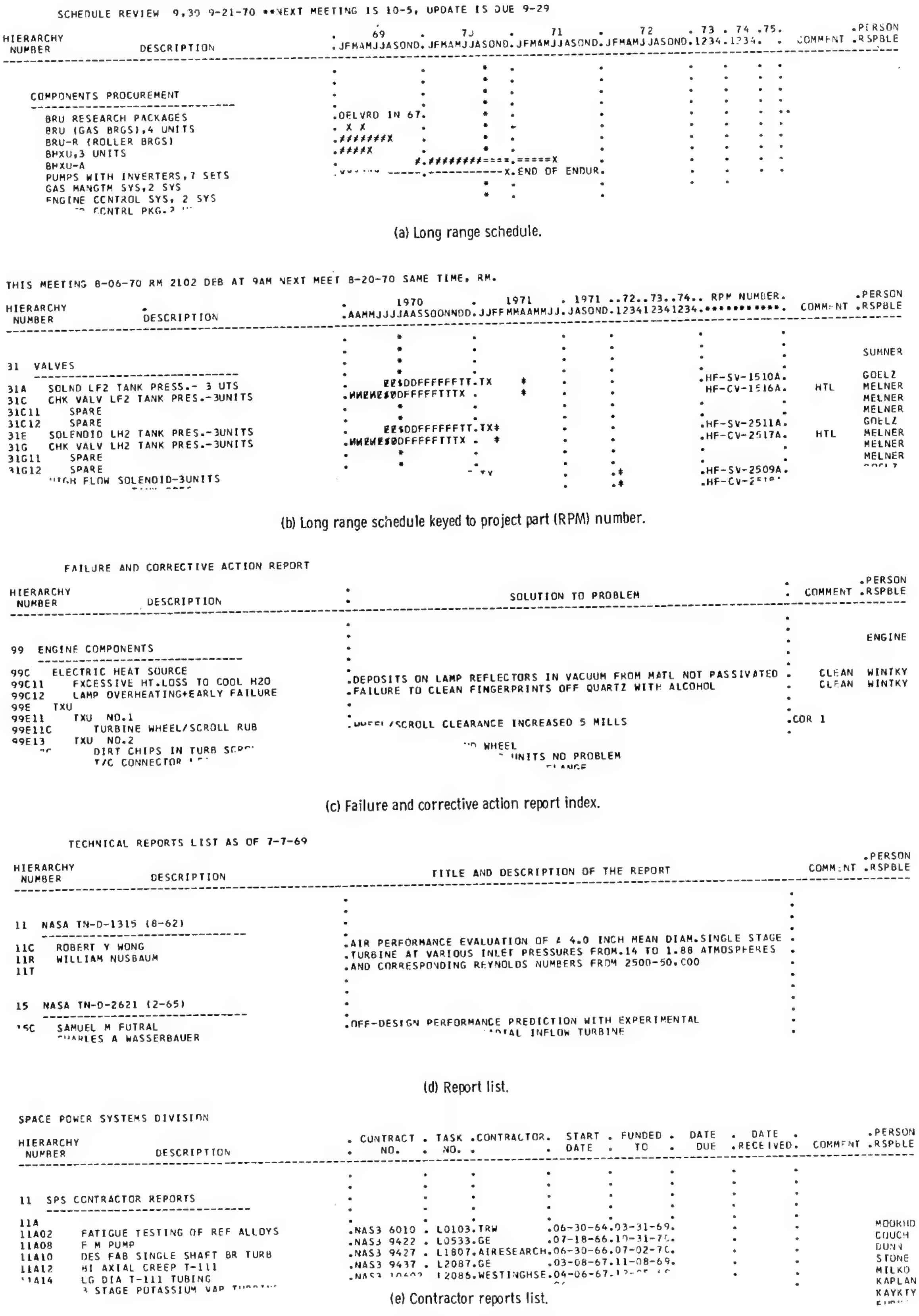


Figure 7. - Deck setup for running multiple programs.



```
SCHEDULE REVIEW  9,30 9-21-70 **NEXT MEETING IS 10-5, UPDATE IS DUE 9-29

HIERARCHY                                       .     69      .     7J      .     71      .     72      . 73 . 74 .75.           .PERSON
 NUMBER              DESCRIPTION                .JFMAMJJASOND.JFMAMJJASOND.JFMAMJJASOND.JFMAMJJASOND.1234.1234.  .  COMMENT .RSPBLE
-------------------------------------------------------------------------------------------------------------------------------------
                                                .           .    .  .           .           .    .    .  .
                                                .           .    .  .           .           .    .    .  .
    COMPONENTS PROCUREMENT                      .           .    .  .           .           .    .    .  .
    ------------------------------              .           .    .  .           .           .    .    .  .
      BRU RESEARCH PACKAGES                     .DELVRD IN 67.   .  .           .           .    .    .  ..
      BRU (GAS BRGS),4 UNITS                    . X X       .    .  -           .           .    .    .  .
      BRU-R (ROLLER BRGS)                       .#######X   .    .  .           .           .    .    .  .
      BHXU,3 UNITS                              .####X      .    .  .           .           .    .    .  .
      BHXU-A                                    .           #.########====.=====X           .    .    .  .
      PUMPS WITH INVERTERS,7 SETS               .vvv--vv -----.-----------X.END OF ENDUR.   .    .    .  .
      GAS MANGTM SYS,2 SYS                                       .  .           .           .    .
      ENGINE CCNTROL SYS, 2 SYS                                  .  .           .
          -- CCNTRL PKG.2 ''
```

(a) Long range schedule.

```
THIS MEETING 8-06-70 RM 2102 DEB AT 9AM NEXT MEET 8-20-70 SAME TIME, RM.

HIERARCHY            .                          .        1970        .    1971     . 1971 ..72..73..74.. RPM NUMBER.            .PERSON
 NUMBER             DESCRIPTION                 .AAMMJJJJAASSOONNDD.JJFFMMAAMMJJ.JASOND.123412341234.***********.  COMM NT .RSPBLE
-------------------------------------------------------------------------------------------------------------------------------------
                                                .      .      .        .      .           .        .
                                                .      .      .        .      .           .        .          SUMNER
31  VALVES                                      .      .      .        .      .           .        .
    ------------------------------              .      .      .        .      .           .        .          GOELZ
31A   SOLND LF2 TANK PRESS.- 3 UTS              .    EE$DDFFFFFFTT.TX   *      .       .HF-SV-1510A.          MELNER
31C   CHK VALV LF2 TANK PRES.-3UNITS            .MMEMEE$ØDFFFFFTTTX .   *      .        HF-CV-1516A.   HTL    MELNER
31C11      SPARE                                .      .      .        .      .           .        .          MELNER
31C12      SPARE                                .      .      .        .      .           .        .          GOELZ
31E   SOLENDID LH2 TANK PRES.-3UNITS            .    EE$DDFFFFFFTT.TX*         .       .HF-SV-2511A.          MELNER
31G   CHK VALV LH2 TANK PRES.-3UNITS            .MMEMEE$ØDFFFFFTTTX .  *       .       .HF-CV-2517A.   HTL    MELNER
31G11      SPARE                                .      .      .        .      .           .        .          MELNER
31G12      SPARE                                .      .      - TX     .      .*       .HF-SV-2509A.          GOELZ
      HIGH FLOW SOLENOID-3UNITS                                        .      .*       .HF-CV-2518
```

(b) Long range schedule keyed to project part (RPM) number.

```
      FAILURE AND CORRECTIVE ACTION REPORT

HIERARCHY                                       .                                                     .          .PERSON
 NUMBER              DESCRIPTION                .                SOLUTION TO PROBLEM                  .  COMMENT .RSPBLE
-------------------------------------------------------------------------------------------------------------------------
                                                .                                                     .
                                                .                                                     .          ENGINE
99  ENGINE COMPONENTS                           .                                                     .
    ------------------------------              .                                                     .
99C    ELECTRIC HEAT SOURCE                     .DEPOSITS ON LAMP REFLECTORS IN VACUUM FROM MATL NOT PASSIVATED .  CLEAN   WINTKY
99C11    FXCESSIVE HT.LOSS TO COOL H2O          .FAILURE TO CLEAN FINGERPRINTS OFF QUARTZ WITH ALCOHOL          .  CLEAN   WINTKY
99C12    LAMP OVERHEATING+EARLY FAILURE         .                                                     .
99E    TXU                                      .                                                     .
99E11    TXU  NO.1                              .WHEEL/SCROLL CLEARANCE INCREASED 5 MILLS             .COR 1
99E11C     TURBINE WHEEL/SCROLL RUB                                                                   .
99E13    TXU  NO.2                                              ND WHEEL
           DIRT CHIPS IN TURB SCRO                                UNITS NO PROBLEM
           T/C CONNECTOR                                            FLANGE
```

(c) Failure and corrective action report index.

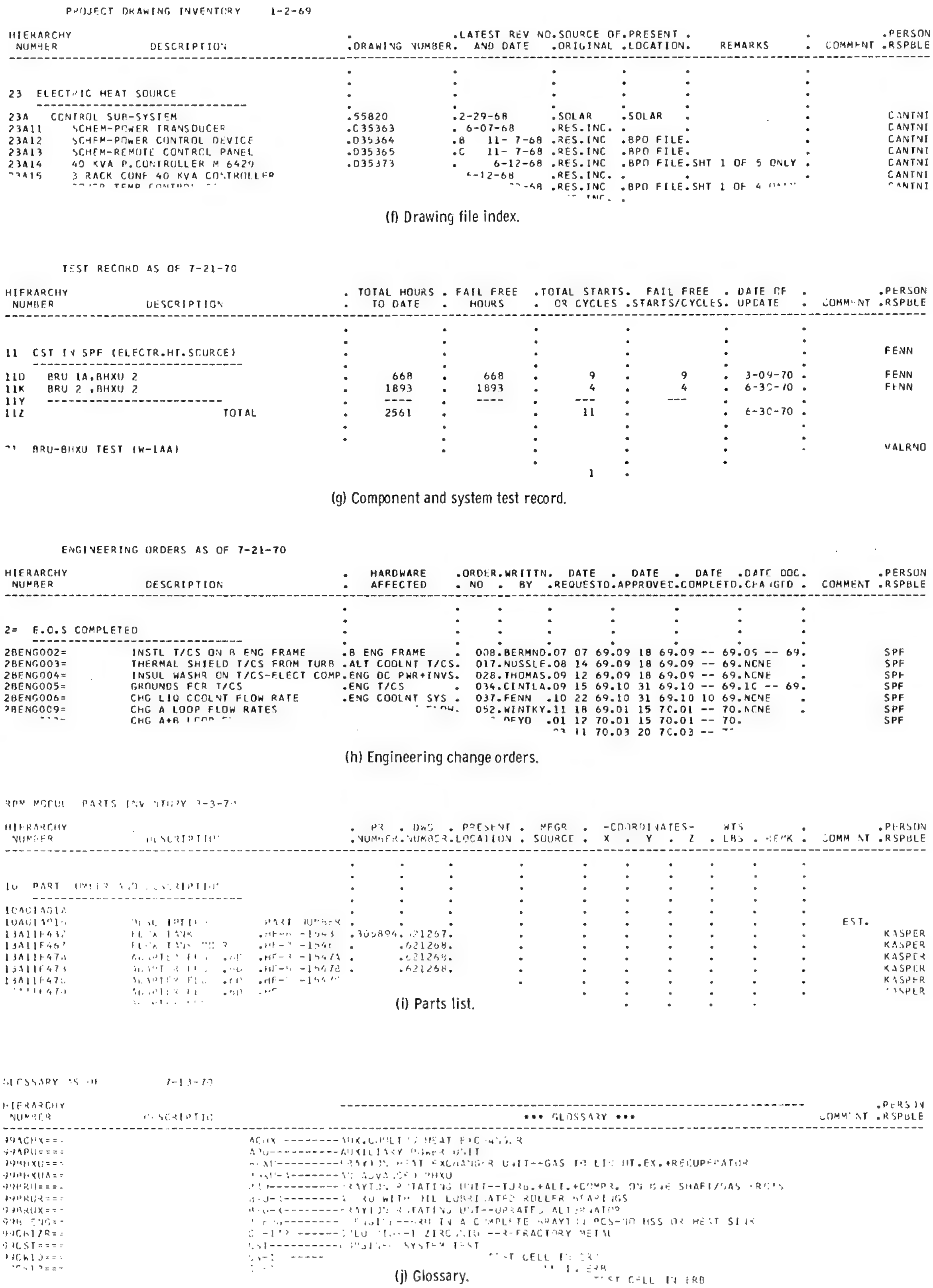
```
      TECHNICAL REPORTS LIST AS OF 7-7-69
                                                                                                                  .PERSON
HIERARCHY                                                   TITLE AND DESCRIPTION OF THE REPORT            COMM:NT .RSPBLE
 NUMBER              DESCRIPTION
-------------------------------------------------------------------------------------------------------------------------
                                                .                                                     .
                                                .                                                     .
11  NASA TN-D-1315 (8-62)                       .                                                     .
    ------------------------------              .                                                     .
11C   ROBERT Y WONG                             .AIR PERFORMANCE EVALUATION OF A 4.0 INCH MEAN DIAM.SINGLE STAGE .
11R   WILLIAM NUSBAUM                           .TURBINE AT VARIOUS INLET PRESSURES FROM.14 TO 1.88 ATMOSPHERES  .
11T                                             .AND CORRESPONDING REYNOLDS NUMBERS FROM 2500-50,000           .
                                                .                                                     .
                                                .                                                     .
15  NASA TN-D-2621 (2-65)                       .                                                     .
    ------------------------------              .                                                     .
15C   SAMUEL M FUTRAL                           .OFF-DESIGN PERFORMANCE PREDICTION WITH EXPERIMENTAL  .
      CHARLES A WASSERBAUER                                     RADIAL INFLOW TURBINE                 .
```

(d) Report list.

```
SPACE POWER SYSTEMS DIVISION

HIERARCHY                                       . CUNTRACT . TASK .CONTRACTOR. START . FUNDED .  DATE  .  DATE   .          .PERSON
 NUMBER              DESCRIPTION                .   NO.    . NO.  .          . DATE  .   TO   .  DUE   .RECEIVED.  COMMENT .RSPBLE
-------------------------------------------------------------------------------------------------------------------------------------
                                                .          .     .           .        .        .        .
                                                .          .     .           .        .        .        .
11  SPS CCNTRACTOR REPORTS                      .          .     .           .        .        .        .
    ------------------------------              .          .     .           .        .        .        .
11A                                             .          .     .           .        .        .        .           MOORHD
11A02     FATIGUE TESTING OF REF ALLOYS         .NAS3 6010 . L0103.TRW        .06-30-64.03-31-69.        .           COUCH
11A08     F M PUMP                              .NAS3 9422 . L0533.GE         .07-18-66.10-31-70.        .           DUNN
11A10     DES FAB SINGLE SHAFT BR TURB          .NAS3 9427 . L1807.AIRESEARCH.06-30-66.07-02-70.        .           STONE
11A12     HI AXIAL CREEP T-111                  .NAS3 9437 . L2087.GE         .03-08-67.11-08-69.        .           MILKD
11A14     LG DIA T-111 TUBING                   .NAS3 10602  L2086.WESTINGHSE.04-06-67.12-                .           KAPLAN
          3 STAGE POTASSIUM VAP TURBINE                                                                            KAYKTY
```

(e) Contractor reports list.

Figure 8. - Examples of various MAPS program uses.



```
        PROJECT DRAWING INVENTORY     1-2-69

HIERARCHY                                          .            .LATEST REV NO.SOURCE OF.PRESENT .                    .          .PERSON
 NUMBER              DESCRIPTION                   .DRAWING NUMBER.  AND DATE  .ORIGINAL .LOCATION.     REMARKS       .  COMMENT .RSPBLE
------------------------------------------------------------------------------------------------------------------------------------------
                                                   .            .              .         .         .                  .
                                                   .            .              .         .         .                  .
23  ELECTRIC HEAT SOURCE                           .            .              .         .         .                  .
    -----------------------------                  .            .              .         .         .                  .
23A   CONTROL SUB-SYSTEM                           .55820       .2-29-68       .SOLAR    .SOLAR    .                  .            CANTNI
23A11     SCHEM-POWER TRANSDUCER                   .C35363      . 6-07-68      .RES.INC. .         .                  .            CANTNI
23A12     SCHEM-POWER CONTROL DEVICE               .D35364      .B    11- 7-68 .RES.INC  .BPO FILE.                   .            CANTNI
23A13     SCHEM-REMOTE CONTROL PANEL               .D35365      .C    11- 7-68 .RES.INC  .BPO FILE.                   .            CANTNI
23A14     40 KVA P.CONTROLLER M 6429               .D35373      .      6-12-68 .RES.INC  .BPO FILE.SHT 1 OF 5 ONLY .            CANTNI
23A15     3 RACK CONF 40 KVA CONTROLLER                            6-12-68     .RES.INC. .         .                  .            CANTNI
                                                                        -68    .RES.INC  .BPO FILE.SHT 1 OF 4                  CANTNI
```

(f) Drawing file index.

```
        TEST RECORD AS OF 7-21-70

HIERARCHY                                          . TOTAL HOURS . FAIL FREE  .TOTAL STARTS.  FAIL FREE  . DATE OF  .          .PERSON
 NUMBER              DESCRIPTION                   .  TO DATE    .   HOURS    . OR CYCLES .STARTS/CYCLES. UPDATE   .  COMMENT .RSPBLE
------------------------------------------------------------------------------------------------------------------------------------------
                                                   .             .            .            .            .          .
                                                   .             .            .            .            .          .
11  CST IN SPF (ELECTR.HT.SOURCE)                  .             .            .            .            .          .           FENN
    -----------------------------                  .             .            .            .            .          .
11D   BRU 1A,BHXU 2                                .     668     .    668     .      9     .      9     .  3-09-70 .           FENN
11K   BRU 2 ,BHXU 2                                .    1893     .   1893     .      4     .      4     .  6-30-70 .           FENN
11Y   -------------------------                    .    ----     .   ----     .     ---    .     ---    .          .
11Z                               TOTAL            .    2561     .            .     11     .            .  6-30-70 .
                                                   .             .            .            .            .          .
                                                   .             .            .            .            .          .
      BRU-BHXU TEST (W-1AA)                                      .            .            .            .          .           VALRNO
                                                                              .            .            .
                                                                                     1     .
```

(g) Component and system test record.

```
        ENGINEERING ORDERS AS OF 7-21-70

HIERARCHY                                          .   HARDWARE    .ORDER.WRITTN.  DATE  .  DATE  .  DATE  .DATE DOC.          .PERSON
 NUMBER              DESCRIPTION                   .   AFFECTED    . NO  .  BY  .REQUESTD.APPROVED.COMPLETD.CHANGED .  COMMENT .RSPBLE
------------------------------------------------------------------------------------------------------------------------------------------
                                                   .               .     .      .        .        .        .        .
                                                   .               .     .      .        .        .        .        .
2=   E.O.S COMPLETED                               .               .     .      .        .        .        .        .
     -----------------------------                 .               .     .      .        .        .        .        .
2BENG002=          INSTL T/CS ON B ENG FRAME       .B ENG FRAME    .  008.BERMND.07 07 69.09 18 69.09 -- 69.09 -- 69.           SPF
2BENG003=          THERMAL SHIELD T/CS FROM TURB   .ALT COOLNT T/CS.  017.NUSSLE.08 14 69.09 18 69.09 -- 69.NONE    .           SPF
2BENG004=          INSUL WASHR ON T/CS-ELECT COMP.ENG DC PWR+INVS.  028.THOMAS.09 12 69.09 18 69.09 -- 69.NONE    .           SPF
2BENG005=          GROUNDS FOR T/CS                .ENG T/CS       .  034.CINTLA.09 15 69.10 31 69.10 -- 69.10 -- 69.           SPF
2BENG006=          CHG LIQ COOLNT FLOW RATE        .ENG COOLNT SYS .  037.FENN  .10 22 69.10 31 69.10 10 69.NONE    .           SPF
2BENG009=          CHG A LOOP FLOW RATES                         .  052.WINTKY.11 18 69.01 15 70.01 -- 70.NONE    .           SPF
                   CHG A+B LOOP                                           OFYO  .01 12 70.01 15 70.01 -- 70.                    SPF
                                                                                  11 70.03 20 70.03 --
```

(h) Engineering change orders.

```
RPM MODUL  PARTS INVENTORY 3-3-70

HIERARCHY                                          .  PR   . DWG   . PRESENT  .  MFGR   .  -COORDINATES-    WTS          .          .PERSON
 NUMBER              DESCRIPTION                   .NUMBER.NUMBER.LOCATION .  SOURCE .  X  .  Y  .  Z  . LBS . REMK .  COMM NT .RSPBLE
------------------------------------------------------------------------------------------------------------------------------------------
                                                   .       .       .          .         .     .     .     .     .      .
                                                   .       .       .          .         .     .     .     .     .      .
10   PART NUMBER AND DESCRIPTION                   .       .       .          .         .     .     .     .     .      .
     -----------------------------                 .       .       .          .         .     .     .     .     .      .
10AC1A01A                                          .       .       .          .         .     .     .     .     .      .
10AC1A01B          DESCRIPTION          PART NUMBER .       .       .          .         .     .     .     .     .      .   EST.
13A11F432          FLUX TANK           .HF-6 -1543 .305896.621267.          .         .     .     .     .     .      .           KASPER
13A11F467          FLUX TANK           .HF-7 -1546 .       .621268.          .         .     .     .     .     .      .           KASPER
13A11F47A          ADAPTER FLG         .HF-3 -1547A.       .621268.          .         .     .     .     .     .      .           KASPER
13A11F473          ADAPTER FLG         .HF-5 -1547B.       .621268.          .         .     .     .     .     .      .           KASPER
13A11F47C          ADAPTER FLG         .HF-  -1547                            .         .     .     .     .     .      .           KASPER
   11F47D          ADAPTER FLG         .HF                                              .     .     .     .     .      .           KASPER
                   ADAPTER                                                                    .     .     .     .
```

(i) Parts list.

```
GLOSSARY AS OF          7-13-70

HIERARCHY                                          ------------------------------------------------------------------------------          .PERSON
 NUMBER              DESCRIPTION                                                  *** GLOSSARY ***                                 COMMENT .RSPBLE
------------------------------------------------------------------------------------------------------------------------------------------
99ACHX===              ACHX ---------MIX,COOLER HEAT EXCHANGER
99APU====              APU-----------AUXILIARY POWER UNIT
99BHXU===              BHXU----------BRAYTON HEAT EXCHANGER UNIT--GAS TO LIQ HT.EX.+RECUPERATOR
99BHXUA==              BHXU-A--------AN ADVANCED BHXU
99BRU====              BRU-----------BRAYTON ROTATING UNIT--TURB.+ALT.+COMPR. ON ONE SHAFT/GAS BRGS
99BRUR===              BRU-R---------A BRU WITH OIL LUBRICATED ROLLER BEARINGS
99BRUX===              BRU-X---------BRAYTON ROTATING UNIT--UPRATED ALTERNATOR
99B ENG=               B ENG---------ENGINE---BRU IN A COMPLETE BRAYTON PCS--NO HSS OR HEAT SINK
99CBIZR==              CB-IZR -------COLUMBIUM-1 ZIRCONIUM --REFRACTORY METAL
99CST====              CST-----------COMPONENT SYSTEM TEST
99CW1D===              CW-1D -----                       TEST CELL
99CW12===                                                      ERB
                                                                       TEST CELL IN ERB
```

(j) Glossary.

Figure 8. - Concluded.

IDENTIFICATION (I.D.) CARD WORK SHEET

		HIERARCHY NO. *(Start in Col. 3)*		TITLE *(Always start in Col. 13)*		RESPON-SIBLE PERSON		OPTIONS						REMARKS
								FLAG		STATUS		COMMENT		
1	2	3 4 5 6 7 8 9 10 11	12	13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42	43	44 45 46 47 48 49	50	51 52 53 54	55	56 57 58	59	60 61 62 63 64 65	66	
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1	2	3 4 5 6 7 8 9 10 11	12	13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42	43	44 45 46 47 48 49	50	51 52 53 54	55	56 57 58	59	60 61 62 63 64 65	66	

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(OP)

Project ______________ Prepared by ______________ Approved by ______________

NOTE: Deletion of I.D. Card automatically deletes corresponding schedule and status cards.

SCHEDULE CARD WORK SHEET

1–2	3–8	9	10–33	34
35–58	59	60–65	66	NEED DATE COL. (A) 67–68
69	HIERARCHY NUMBER *(Start in Col. 70)* 70–78	79–80		

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

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(OP)

Project __________ Prepared by __________ Approved by __________

(A) Must be two digit (e.g., 08, 25) or blank.

STATUS CARD WORK SHEET

HIERARCHY NO. *(Start in Col. 1)*									STATUS													COMMENT						REMARKS *(Delete, etc.)*
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	

NOTES

1. Use plus or minus in Column 15, and a two-digit number in Columns 16 and 17 to denote status referenced to asterisk cursor column. Two-digit number implies columns away from the asterisk. Numbers less than 10 must be written with a zero in Column 16 (e.g., +03, -07). Period (.) in Column 15 suppresses the slash overprint of narrative notes used in the schedule area.

2. Comment columns can be used to elaborate on the status with words of six characters or less such as "late, lost, $5,000, 302 HRS" or by a code related to the legend.

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(OP)

Project ______________________ Prepared by ______________________ Approved by ______________________

MASTER FORM FOR PREPARATION OF SPECIAL FORMS

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

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>
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